Note by the Secretary

1. In Resolution 4/2011, the Governing Body called for the necessary measures to realize technology transfer to be facilitated. The Governing Body may wish to note that the Rio Six-point Action Plan for the International Treaty, which was adopted at the Second High-level Roundtable of the Treaty, recommends, as one of the priority actions to be undertaken by stakeholders in the Treaty, to establish a platform for the co-development and transfer of technology within the context of non-monetary benefit-sharing under the Treaty.

2. This document contains the reports of two meetings, held respectively in Brasilia, Brazil, in August 2012, and Bandung, Indonesia, in July 2013, under the co-chairing of the Brazilian Agriculture Research Corporation (Embrapa) and the Indonesian Agency for Agricultural Research and Development (IAARD). The meetings were to discuss the establishment of the above platform.

3. Following the recommendation of the Ad Hoc Committee on Sustainable Use to link the platform with the programme of work on sustainable use of plant genetic resources for food and agriculture, such programme, as proposed in document, IT/GB-5/13/9, Implementation of the Article 6, Sustainable Use of Plant Genetic Resources for Food and Agriculture, refers to the platform as one of the support initiatives undertaken by Treaty stakeholders.
REPORT

WORKSHOP TO DISCUSS A PLATFORM
FOR THE CO-DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

Brasília, 7-8 August 2012

Background

The International Treaty on Plant Genetic Resources for Food and Agriculture is the legally binding international framework for the conservation and sustainable use of these crucial resources, which are the basis of world food security, as well as for the fair and equitable sharing of the benefits arising from their use (Article 1.1).

Monetary benefit-sharing is effected though the Treaty’s Benefit-sharing Fund, with moneys deriving from the sale of products that incorporate plant genetic resources for food and agriculture, as well as from contributions to the fund by Contracting Parties (Article 13.2.d). Two calls for proposals have been issued, and a third is in preparation. One of the funding priorities adopted by the Governing Body for the use of these resources is “information exchange, technology transfer and capacity-building”.

The Treaty calls for technology transfer as a form of non-monetary benefit-sharing (Article 13.2.b), backed by information exchange (Article 13.2.a), and capacity-building (Article 13.2.c). The Treaty provides that transfer of technology to countries … shall be carried out through … all types of partnership in research and development (Article 13.2.b.iii). Priority is given to “the implementation of agreed plans and programmes for farmers in developing countries … who conserve and sustainably utilize plant genetic resources for food and agriculture” (Article 18.5).

The Treaty’s Governing Body, in all its sessions including its last, has called for Contracting Parties and other relevant stakeholders to explore innovative ways to realise effective technology transfer (Resolution 4/2011), emphasizing that technology transfer is required to enhance the capacity to use plant genetic resources for food and agriculture through plant breeding, including the utilization of modern tools, traditional varieties and the participation of farmers.

In March 2011, the Governments of Indonesia and Norway accordingly convened a Global Consultation on Benefit-sharing under the Multilateral System, in Bogor, Indonesia, which focused on particular ways to realize technology transfer, in support of the Treaty.

At the United Nations Conference on Sustainable Development (Rio de Janeiro, Brazil, 21 June 2012), a High-level Round Table convened by the Governments of Brazil, Indonesia and Norway, adopted the Rio Six-point Action Plan for the International Treaty. It recommended, as a priority, that stakeholders in the Treaty “establish a Platform for the Co-Development and Transfer of Technologies, within the context of non-monetary benefit-sharing under the Treaty”.

The workshop

In the spirit of implementation of the call by the Governing Body, and following the relevant priority indicated in the Rio Six-point Action Plan, the Brazilian Agriculture Research Corporation (Embrapa) and the Indonesian Agency for Agricultural Research and Development (IAARD) hosted a workshop of a number of international and national institutions with skills and experience in agricultural technologies, in the public and the private sector, to discuss how to take up the challenge. A number of national and international institutions, in the public and private sectors, were invited for initial discussions as to how the Platform might be established within the Treaty’s Funding Strategy.

The list of participants in the workshop is in Annex 1. The agenda of the workshop is in Annex 2.

The challenge of creating a systematic approach to technology transfer

The workshop recognized that the call for technology transfer is an integral component of the Convention on Biological Diversity, the Treaty, and other international instruments, and there is an expectation from the target beneficiaries identified in such instruments that some specific action would be taken to realize technology transfer. It recognized also that technology transfer is crucial for food security, particularly in developing countries.

The workshop noted the difficulty that has in the past been faced in finding an effective approach to technology transfer, and that this is creating uncertainties and tensions around the concept of non-monetary benefit-sharing. It realized that technology is being transferred all the time, in many different ways, through international and national research institutions, through a variety of international projects, and through the commercial sector. It recognized that there is no specific methodology to focus proactively on technology transfer as a form of benefit-sharing, and that an objectives-driven platform would be desirable to create such a methodology, under the aegis of a number of key institutions. In this way, it could identify what is being done in support of the Treaty.

The participants presented and discussed the many types of technology transfer in which they were involved. There was a general agreement that technology transfer almost always is in the context of a packet of activities, which also include not only information exchange and capacity-building, but often require policy and infrastructural support. It felt that a coherent approach to proactive technology transfer could be sought by bringing together a variety of activities by a number of actors, in order to create “technology transfer packets”, with the objective of providing “one-stop shop” solutions to the expressed needs of the target communities and end users, which, in the context of the Treaty, are mainly farming communities in developing countries, particularly when challenged with the difficulties of adapting to climate change.

The workshop agreed on a number of principles. These included that technology should be understood in a very wide sense; that technology transfer should aim to solve problems, not impose specific solutions. For this reason, the workshop believed that a Platform, where institutions active in technology transfer, including technical bodies and donor institutions could together work to structure technology transfer packets. The Platform could provide a coordination and initiation mechanism, which could make a substantial contribution to mobilizing resources, including those of the initial proponents themselves, and to focusing technology transfer initiatives.

The workshop accordingly drafted and adopted the Draft Mission Statement that is attached, as Annex 3. It requested the Secretary of the Governing Body to circulate the mission statement to all Contracting Parties. The Secretary also undertook to brief the Bureau on the outcomes of the workshop. He also agreed to organize a briefing on the platform initiative for Permanent Representative of Contracting Parties in Rome.
Possible structures for the Platform

The participants recognized the need for wide consultations, including with other possible active partners, and with advisory institutions. For the moment, it agreed to proceed in an informal manner, and decided to take up the matter again at its next meeting.

The workshop agreed that the initial proponents of the Platform should be institutions with useful skills and experience that they are prepared to put at the service of the Platform. The willingness of an institution to actively engage with the Platform should be a criterion for possible membership. While seeking broad consultations and support, the workshop hoped to keep the functioning of the Platform focused and action-oriented.

It was agreed that the Platform might take the form of an initiative within the Treaty’s Funding Strategy. This meant that the Platform would inform the Governing Body of its objective and proposed activities, and seek the advice and support of the Governing Body. It would then report periodically on the implementation of its programme.

The Platform and the Benefit-sharing Fund

The workshop also agreed that, if the Governing Body and Bureau of the Treaty so wish, it would make available its technical advice and experience to support the process of developing and presenting projects under the Benefit-sharing Fund, including in the next call for proposals.

Next steps

The workshop agreed to accept the invitation of the National Innovation Foundation (NIF) - Society for Research Into Sustainable Technologies and Institutions (SRISTI), to convene its next meeting in Ahmadabad, India, and tentatively agreed on the dates of 10 to 12 December 2012. It agreed that a number of key institutions should be consulted, and invited to attend the next meeting.

It requested the preparation of a number of analytical papers, around which to structure the next meeting, including:

1. An analysis of technologies identified as needed, or likely to be of key importance in the projects of the African Agriculture Technology Foundation (AATF), in Embrapa’s “marketplaces”, and based on any other useful data sources;
2. An assessment of the technologies being demanded and/or being accessed within the list of projects so far approved in the different calls for proposals of the Benefit-sharing Fund;
3. An assessment of current models of technology transfer;
4. An analysis of the grey literature on future technologies in relation to future needs;
5. Possible institutional designs for the Platform and its activities.

The Treaty Secretariat was requested to establish an on-line workspace for communications in preparation of the second meeting.

While the initial proponents of the Platform could do much of the work for preparing the next meeting, it was recognized that the provision of dedicated staff able to prepare the meeting, and manage the wider necessary consultations, would be very productive. It invited the Secretary of the Governing Body to investigate whether some donor support could be mobilized for the purpose in the period leading to the final establishment of the Platform and the initiation of its activities.
Embrapa and IAARD representatives, joined by the other participants, thanked the Secretariat of the Treaty, the Secretary of the Governing Body, Dr. Shakeel Bhatti, staff and consultants for the enormous dedication to the preparation of the event.
### Annex I: Participants

<table>
<thead>
<tr>
<th>INSTITUTION</th>
<th>PERSON</th>
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</thead>
<tbody>
<tr>
<td>Embrapa</td>
<td>Mauricio Lopes, Maria Jose Sampaio, Paulo Duarte, Luciano Naas</td>
</tr>
<tr>
<td>NIF/SRISTI</td>
<td>Vipin Kumar</td>
</tr>
<tr>
<td>IAARD</td>
<td>Muhamad Sabran</td>
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<tr>
<td>AATF</td>
<td>Al-Haji Tejan-Cole</td>
</tr>
<tr>
<td>Center for Genetic Resources, The Netherlands (CGN-Wageningen)</td>
<td>Bert Visser</td>
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<tr>
<td>Syngenta (Co)</td>
<td>Maria Cecilia Oswald</td>
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<tr>
<td>UPOV (technical advisory partner)</td>
<td>Peter Button</td>
</tr>
<tr>
<td>WIPO (technical advisory partner)</td>
<td>Anatole Krattiger</td>
</tr>
<tr>
<td>FAO Representation in Brazil (support office)</td>
<td>Marcello Broggio, Gustavo Chianca</td>
</tr>
<tr>
<td>Secretariat of the International Treaty (support office)</td>
<td>Shakeel Bhatti, Alvaro Toledo, Clive Stannard</td>
</tr>
<tr>
<td>Brazilian Ministry of Agriculture</td>
<td>Roberto Lorena</td>
</tr>
<tr>
<td>Brazilian Ministry of Environment</td>
<td>Lidio Coradin</td>
</tr>
<tr>
<td>Brazilian Ministry of Foreign Affairs</td>
<td>Paulino de Carvalho Neto, Paula Rassi</td>
</tr>
</tbody>
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Annex 2: Workshop agenda

PLATFORM FOR THE CO-DEVELOPMENT AND TRANSFER OF TECHNOLOGIES
FIRST WORKSHOP

7th – 8th August 2012
Embrapa CECAT – Tambaqui Room
Brasilia, Brazil

7th AUGUST 2012

(09.00 – 9.30)
➢ Opening and Welcome
  o Brazilian Agriculture Research Corporation (Embrapa) – Pedro Arraes
  Ministry of Agriculture, Livestock and Food Supply – Roberto Lorena
  Ministry of Environment – Prof. Roberto Cavalcanti
  o Indonesian Agency for Agricultural Research and Development – Muhamad Sabran
  o Chairman of the Second High-level Roundtable on the International Treaty at Rio+20 – Mauricio Lopes
  o Secretary of the International Treaty – Shakeel Bhatti

(09.30 – 11.30)
➢ Review and approval of the agenda
  Co-Chairs – Savio Mendonça (Brazil) and Muhamad Sabran (Indonesia)
  Rapporteur – M.J. Sampaio
➢ The background to the Workshop: Benefit-sharing in the Context of the Treaty
  Shakeel Bhatti, Secretary, International Treaty
➢ Non-monetary benefit-sharing under the Treaty
  Bert Visser, Center for Genetic Resources (CGN), Netherlands
➢ Expected outcomes of the Workshop
  Clive Stannard

(11:30 – 13:00)
➢ Embrapa as a Working Partner
  o Brazilian Agriculture Research Corporation – Dr. Mauricio Lopes
  o Sharing Experiences for the Work of the Platform: past successes and failures in co-developing and transferring agricultural technologies
  o Embrapa’s experiences – Dr. Filipe Teixeira
(13.00 – 14.00)
➢ Lunch at Embrapa

(14.00 – 14:30)
➢ Technology transfer for directions established by the Governing Body
  o Ensuring focus and impact: focusing on assisting farmers to adapt to climate change
    with a special focus on improving nutrition with selected crops
  o Technology recipients’ support needs

  Shakeel Bhatti

(14.30 – 15.30)
➢ 10 minutes presentations by each potential partner institution on their capacity
  & potential contributions to the Platform related to technology transfer, exchange of
  information and capacity building (e.g. partners in co-development, policy
  makers/institutional drivers, helpdesk, implementing entities, brokers, etc)

  Potential Working Partners:
  o Indonesian Agency for Agricultural Research and Development - Dr. Muhamad
    Sabran
  o African Agricultural Technology Foundation - Al-Haji Tejan-Cole
  o National Innovation Foundation/SRISTI -
    o Prof. Anil Gupta (video address)
    o Dr. Vipin Kumar
  o Center for Genetic Resources (CGN) – Dr. Bert Visser
  o Syngenta – Cecilia Oswald

  Potential Consulting Partners:
  o G-20 Tropical Agriculture Platform – Andrea Sonnino (video address)
  o UPOV - Peter Button
  o WIPO - Anatole Krattiger

(15:30 – 16:30)
Two Breakout Groups:
➢ The role and contributions of working partners in the Platform:
  o How the relationships will work
  o How the working partners will identify potential contributions and activities
  o How do the partners work with each other and, collectively, engage others
  o How will the partners report to the Governing Body
  o Short- and long-term objectives and possible development paths for the Platform
  o Transaction costs and resource needs

(16.30 – 16.45)
Coffee break

(16:45 – 17:45)
➢ Continued: The role and contributions of working partners in the Platform
➢ Group rapporteurs to prepare summary for next day
8th August 2012

(09.00 – 9.45)
Rapporteurs - summaries

(09.45 – 10.15)
➢ Technology transfer within the context of existing projects of the Benefit-sharing Fund

Treaty Secretariat - Álvaro Toledo

(10.15 – 10.45)
➢ Coffee break

(10.45 – 12:00)
➢ Enhancing technology transfer in the next Call for Proposals of the Benefit-sharing Fund:

Advice from the Working Partners on a possible TT window of the BSF:
- Project design and structure: project templates; partnership arrangements, length and size of projects; technology transfer methodologies
- Criteria for screening and appraisal of proposals
- Helpdesk arrangements

(12.00 – 13.00)
➢ Launching the Platform and testing pilot proposals on technology transfer in the next Call for proposals of the Benefit-sharing Fund:
- the role of the Platform;
- the support from a possible Call window

(13.00 – 14.00)
➢ Lunch at Embrapa

(14.00 – 17.00 with coffee break at 16.30)
➢ Planning for the Platform: Next steps for the partners
  - Defining the concept of the platform
  - Identification of a Chair for immediate activities
  - Possible other partners
  - Activities of the partners in the next year
    - Contribution of the platform to the various stages of the third round of the project cycle
    - Next meetings and follow-up
    - Informing the Governing Body
    - External events: informing Contracting Parties and other stakeholders

(17.00 – 17.30)
➢ Closing - summary
Annex 3

PLATFORM FOR
THE CO-DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

IN SUPPORT OF
THE FUNDING STRATEGY OF THE INTERNATIONAL TREATY ON PLANT GENETIC
RESOURCES FOR FOOD AND AGRICULTURE

DRAFT MISSION STATEMENT

The International Treaty on Plant Genetic Resources for Food and Agriculture is the international framework for the conservation and sustainable utilization of plant genetic resources for food and agriculture, and the fair and equitable sharing of the benefits. Such benefits flow, as a priority, to farmers in developing countries, especially in least developed countries, who conserve and sustainably utilize plant genetic resources for food and agriculture.

The Treaty calls for technology transfer as a primary form of non-monetary benefit-sharing. The Treaty calls for technology transfer as a primary form of non-monetary benefit-sharing. Technology transfer is also a major objective of many other international agreements. The Governing Body of the Treaty has called for measures to realise effective technology transfer and has invited Contracting Parties and other relevant stakeholder to explore innovative benefit-sharing measures for technology transfer.

The Rio Six-point Action Plan for the International Treaty recommends, as a priority action to be undertaken by stakeholders in the Treaty, “to establish a Platform for the Co-Development and Transfer of Technologies, within the context of non-monetary benefit-sharing under the Treaty”.

1 Articles 13.1, and, in particular, 13.2b and d.
2 Convention on Biological Diversity, etc.
5 Non-monetary benefit-sharing means that “benefits arising from the use […] of plant genetic resources for food and agriculture […] shall be shared fairly and equitably through […] the exchange of information, access to and transfer of technology [and] capacity-building” (Article 13.2). Non-monetary benefit-sharing may involve the provision of financial support. Monetary benefit-sharing is a specific requirement “that a recipient who commercializes a product […] that incorporates material accessed from the Multilateral System, shall pay […] an equitable share of the benefits arising from the commercialization of that product” (Article 13.2d(ii)).
An integrated global operational mechanism to promote, support and realize technology transfer related to plant genetic resources for food and agriculture, for the benefit of small-scale farmers in developing countries, offers an innovative approach to effective benefit-sharing. A group of institutions with expertise of relevant technologies of a wide range of types has therefore, by common agreement, undertaken to establish such a platform, as an initiative within the Funding Strategy of the Treaty,\(^6\) in order to create a methodology to enable technology transfer to meet the needs of such beneficiaries. The benefits are intended to include: improved food security; social and economic development; improved resilience in their farming systems, and in particular, an improved capacity to adapt to climate change, through the use of plant genetic resources for food and agriculture.

The Platform seeks:

1. To respond to needs identified by target beneficiaries;
2. To create a functioning network of institutions with the skills and experience to support and undertake initiatives and projects that aim to co-develop and transfer technologies\(^7\) to beneficiaries in developing countries;
3. To contribute to food security, and the social and economic development of the target beneficiaries, through the establishment of a “one-stop shop” for coherent “technology transfer packets”;
4. To promote the co-development and transfer of technologies, recognizing that technology transfer requires a range of supporting activities, in particular capacity- and institution-building;
5. To mobilize in-kind contributions from both the public and the private sectors for this purpose.
6. To mobilize financial and in-kind support to deliver relevant technologies, including through the Treaty’s Benefit-sharing Fund;
7. To support the implementation of the Benefit-sharing Fund project cycle through the provision of relevant expert advice and capacity.

The Platform will adhere to the following principles:

1. The Platform considers that technology transfer is a means to deliver benefits to target beneficiaries, rather than an end in itself.
2. The Platform recognizes that there is a wide range of approaches to technology transfer, and a broad range of potential solutions, in responding to needs.
3. The Platform will work within the context of the Treaty’s Funding Strategy. The establishment of the Platform will be reported to the Fifth Session of the Treaty’s Governing Body in 2013, and progress reports will thereafter be made to all sessions.
4. The Platform will consult with a wide range of stakeholders in the Treaty, in developing and implementing its activities.
5. In keeping with the Treaty’s multilateral objectives, genetic materials developed in the context of initiatives and projects supported by the Platform will be available through the Treaty’s Multilateral System of Access and Benefit-sharing.

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\(^6\) Article 18.

\(^7\) Technology is the making, modification, usage, and knowledge of tools, machines, techniques, crafts, systems, methods of organization, in order to solve a problem, improve a pre-existing solution to a problem, achieve a goal or perform a specific function.
SECOND MEETING OF THE PLATFORM FOR THE CO-DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

Bandung, West Java, Indonesia, 30 June-1 July 2013

REPORT

1. Background

The International Treaty on Plant Genetic Resources for Food and Agriculture calls for technology transfer, as a primary form of non-monetary benefit-sharing, in the context of its Multilateral System of Access and Benefit-Sharing. At its Fourth Session, the Governing Body therefore called for “the necessary measures to realize technology transfer” to be facilitated. The Rio Six-point Action Plan for the International Treaty, which was adopted at the Second High-level Roundtable of the Treaty on the occasion of the United Nations Conference on Sustainable Development, identifies, as one of the priority actions to be undertaken by stakeholders in the Treaty, the establishment of “a Platform for the Co-Development and Transfer of Technologies, within the context of non-monetary benefit-sharing under the Treaty”.

A number of potential Action Partners therefore convened a meeting in Brasilia, Brazil, in August 2012, co-chaired the Brazilian Agriculture Research Corporation (Embrapa) and the Indonesian Agency for Agricultural Research and Development (IAARD). The meeting envisaged establishing such a Platform, where institutions active in technology transfer, including technical bodies and donor institutions, could work together to structure and promote practical technology. It envisaged the Platform as a coordination and initiation mechanism to mobilize resources, including those of the Action Partners themselves, and to promote and support technology transfer initiatives, and made arrangements for a series of preparatory activities for a second meeting, which would look in more depth into the proposed Platform.

IAARD convened this second meeting, on the occasion of the Third High Level Round Table on the International Treaty, which would provide an opportunity for the Minister of Agriculture of Indonesia, H.E. Suswono to report on the Platform initiative, in the context of a review of follow-up to the The Rio Six-point Action Plan.

The list of participants in the meeting is in Annex 1. The agenda of the meeting is in Annex 2.

2. The meeting

As the Brasilia meeting had requested, the present meeting reviewed a number of analytical documents intended to allow the Action Partners to progress towards a better definition definition of the objectives, scope and modalities through which the Platform could be established. The key documents are attached to this Report.

One focus was the identification of the expressed needs of the target beneficiaries of the Platform’s activities.

- Technologies needed by smallholder farmers in Indonesia for conservation and sustainable use of plant genetic resources for food and agriculture (Annex 3).
• An assessment of needs expressed under the two project cycles of the Benefit-Sharing Fund (Annex 4).

A second focus was a review of models and methodologies for technology transfer, with the aim of identifying the added value that the Platform could bring to international technical transfer initiatives and how this could be structured as non-monetary benefit-sharing in support of the International Treaty.

• Assessment of models of transfer of technology as benefit-sharing under the Multilateral System (Annex 5).
• Addressing global challenges through agricultural technology transfer – a list of selected literature (Annex 6).

A number of Action Partners also presented their direct experience with various aspects of technology transfer and made proposals for priority activities that the Platform could support. The African Agricultural Technology Foundation illustrated its relevant core functions and activities, such as technology identification, brokering, adaptation and delivery, and presented its commercialization portal under the Water Efficient Maize for Africa project as an example of market-based technology delivery. Embrapa introduced a proposal for an information management and sharing portal, which would combine the non-monetary benefit-sharing components of the International Treaty (i.e. capacity-building, access to and transfer of technology, exchange of information) with the facilitated access to genetic material. As Embrapa proposed, the Platform could bring together interested action partners in order to conceptualize, cost and deploy the portal, as a pilot facility of the Platform, and identify flagship institutions for the pilot facility. The National Innovation Foundation of India illustrated its reward system for farmer innovators and expressed willingness to make available farmers’ varieties and associated technologies through the portal.

The meeting was informed of progress towards the establishment of a Public-Private Partnership for Pre-breeding, by a separate group of stakeholders in the International Treaty, which was another of the recommendations of The Rio Six-Point Action Plan, and agreed that there could be much synergy between that and the Platform, for instance in the form of a dedicated facility to support technology co-development and transfer in the work of the Public-Private Partnership for Pre-breeding.

The meeting was also informed of plans by the Secretariat to collect, in accordance with the instructions received by the Governing Body and under the guidance of the Ad Hoc Committee on the Funding Strategy, information generated by projects of the Benefit-sharing Fund, and considered that the Platform could integrate a facility to gather, systematize and share such information.

3. Creating a systematic approach to technology co-development and transfer

The focus on identifying the real needs of the targeted beneficiaries, namely small farmers and their communities, on responding to perceived problems, and on assembling technology packets that could draw together the skills and resources of the action partners, was confirmed.

The meeting highlighted the gaps between the needs and the deployment of appropriate technology packets, and concluded that a problem solving-based approach (i.e. the identification of existing constraints as the basis for undertaking a technology co-development and transfer initiative), in a programmatic manner, would be effective in determining the scope of action of the Platform and making the Platform operational.

The meeting underscored the pivotal role of information-sharing, if farmers are to be enabled to participate effectively in technology co-development and transfer activities. The meeting agreed to follow a broad conceptualization of technology co-development and transfer, which, following the provisions of the International Treaty on non-monetary benefit-sharing, should encompass
information-sharing and capacity-building, including training and other activities instrumental to fostering technology absorption capacity, as elements of the technology packets.

Based on actual examples of technology co-development and transfer, the meeting considered the distinction between germplasm (i.e. material intensive) and non-germplasm based (i.e. information intensive) technology co-development and transfer, and determined that a combination of the two would be the most effective. The meeting also highlighted an understanding technology co-development and transfer pathways, and the mapping of the actors involved, as useful themes to explore for the Platform to undertake the development of specific technology packets.

The meeting noted the variety of exiting models of technology transfer, and, given the absence of an agreed definition of technology transfer in international law, found it appropriate for the Platform not to adopt one single model, but to evaluate the usefulness of different models based on parameters such as the capacity of a model to lead to integrated technology packets, and to technologies adapted to the needs of small farmers and their communities.

The meeting considered that, regardless of the model, appropriateness and affordability should remain key criteria for technology co-development and transfer, if the Platform’s activities were to become a realistic form of non-monetary benefit-sharing within the International Treaty. The meeting noted that a simple assessment of individual technologies against those parameters would not be practical, as it would be the packet constructed around a technology or set of technologies, with supporting functions, that would best achieve this. The meeting reaffirmed that the added value generated by the Platform would be to bring together a core group of key institutions and practitioners, which provide the framework in which a mixture of technologies and complementary activities, such as institution and capacity-building, could be brought together, to provide equitable and effective solutions.

The meeting recommended that the Platform should also pursue stewardship of the delivered technology packets, though the development of standardized conditions (e.g. humanitarian clauses) that would reduce transaction costs, in line with the spirit of the Multilateral System of Access and Benefit-Sharing.

The meeting also agreed that the Platform should continue seeking synergies with existing mechanisms of the International Treaty, such as the Benefit-Sharing Fund, and with highly respected institutions active in technology brokering, adaptation and delivery.

4. Possible structures for the Platform

In regard of the practical organization of the Platform and its activities, the meeting noted that all the action partners expressed a commitment to advancing non-monetary benefit-sharing under the umbrella of the Treaty through the Platform. It agreed that the Platform had the flexibility and the potential to host a number of facilities, such as the proposal that Embrapa had advanced, with the Support of IAARD and AATF, for an information management and sharing portal; and a process to build on the information and improved genetic resources resulting from projects supported under the Benefit-sharing Fund, so that these might be shared with other stakeholders. The Platform also recognized the opportunity that cooperation with the Public-Private Partnership for Pre-Breeding represented.

Within the framework of each of these facilities, core teams of action partners, with the support of technical advisory partners, could develop and implement a range of important activities, such as the documentation of good practices or the identification of existing potential components of technology packets. The action partners could individually or jointly implement activities of the facilities, or host facilities. The facilities themselves should follow the broad parameters of being demand-driven, action-oriented, problem-based and incremental.
The meeting also recognized that, for coherence and coordination, a light, informal platform structure was needed, with a broad but strategic programmatic approach, and with coordination being provided through interim Secretariat support.

The meeting agreed that membership should remain open to other interested partners who wish to work within it, and technical advisors whose experience and expertise are relevant in the context the different facilities of the Platform. It agreed that, at this early stage of development, the priority should be to launch the platform, and to undertake the pilot activities, rather than to immediately formalize institutional arrangements.

The meeting agreed on the following programmatic and institutional steps:

- The elaboration of a strategic paper, setting forth the programmatic approach of the Platform, to be commissioned by the Secretariat to independent experts;
- The preparation and circulation of a draft collaboration agreement among action partners, to be prepared by the Secretariat, for the review by the action partners;
- The identification by the action partners of officers to represent the Platform, and to move its preparations along, bearing in mind that, at the Brasilia meeting, Dr. Mauricio Lopes, the President of Embrapa, had agreed to act as Interim Chairman of the Platform;
- Subject to the availability of funding, the convening of an annual meeting of action partners and technical advisors, open to all interested persons, including donors, which would receiving an implementation report from the various Platform facilities;
- Subject to the availability of funding, the preparation of an annual plan of work by the Secretariat, in collaboration with key action partners of each facility, to be reviewed and agreed at the annual meeting;
- A periodic review of the programmatic approach set forth in the strategic paper.

The meeting agreed on an annual default timeline for the start-up of the Platform, through the above activities.

The meeting agreed that the information portal to be developed by Embrapa, with the support of IAARD and AATF, would be the pilot facility of the Platform. It recommended that, on the basis of mock-up of the portal design by AATF, more consultations would be held in the small group of the institutions actually involved in the proposal, and with the participation of UPOV and Bioversity International as technical advisory partners. A concept note and work plan for the pilot facility, including the selection of crops targeted, would then be prepared and circulated among all the action partners and technical advisors for comments, between August and December 2013.

### 5. Conclusion

The meeting agreed that Embrapa and IAARD should report on progress made towards establishing and launching the Platform, as practical non-monetary benefit-sharing in support of the International Treaty, and in implementation of one of the elements of the The Rio Six-Point Action Plan, at the forthcoming Fifth Session of the Governing Body.

The meeting warmly thanked IAARD for its continuous leadership and strategic vision in developing the Platform, and for its generous and effective hosting. It also thanked the participants, many of whom had travelled far, for their interest and support, and their valuable technical contributions.
# Annex 1

## Second Meeting of the Platform for the Co-Development and Transfer of Technologies

### Bandung, West Java, Indonesia, 30 June - 1 July 2013

## List of Participants

<table>
<thead>
<tr>
<th>Institution</th>
<th>Person</th>
</tr>
</thead>
</table>
| NIF/SRISTI  | Mr Vipin KUMAR  
Society for Research and Initiatives for Sustainable Technologies and Institutions  
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SECOND MEETING OF THE PLATFORM FOR THE CO-DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

Bandung, West Java, Indonesia, 30 June-1 July 2013

AGENDA

30 June

(9.00 – 10.00)
- Opening and welcome - Indonesian Agency for Agricultural Research and Development (IAARD)
- Welcome address by Mr Is’haq bin Ahmed Al Ruqaishi, Undersecretary, Ministry of Agriculture and Fisheries, Oman
- Video message by H.E. Dr Fuad Bin Jaafar Al Sajwani, Minister of Agriculture and Fisheries, Oman
- The role of technology transfer in fulfilling the objectives of the Treaty – Mr Javad Mozafari, Chairperson of the Fifth Session of the Governing Body
- Objectives of the meeting - Secretariat of the International Treaty

(10.00–10.45)

FIRST SESSION: STATUS OF THE PLATFORM

- The outcomes of the Brasilia meeting (30 min.) - Secretariat of the International Treaty
- Report by Action Partners on follow up activities (15 min.)

(10.45 – 11.15)

Coffee break

(11.15 – 13.00)

SECOND SESSION: ANALYSIS OF THE DEMANDS FOR TECHNOLOGY BY FARMERS

- Analysis of technologies identified as needed, or likely to be of key importance for farmers in developing countries (60 min.)
Technologies needed by smallholder farmers in Indonesia for conservation and sustainable use of plant genetic resources for food and agriculture, *presentation by IAARD*

An assessment of needs expressed under the two project cycles of the Benefit-Sharing Fund, *presentation by the Secretariat of the International Treaty*

- Discussion of papers with participants (45 min.) - chaired by IAARD

(13.00 – 14.00)

Lunch

(14.00 – 15.30)

SECOND SESSION (CONT.)

- Needs assessment: further national perspectives (45 min.) - presentations by GRPI 2 partners
- Discussion with participants (45 min.) - chaired by Secretariat of the International Treaty

(15.30-17.00)

THIRD SESSION: REVIEW OF CURRENT MODELS OF TECHNOLOGY TRANSFER

- Analysis of current models (30 min.) - presentation by Prof. Carlos Correa, University of Buenos Aires
- An example of technology transfer: the WEMA commercialization portal (30 min.) - presentation by Ms Jane Achando, AATF
- Potential synergies between the Platform and the pre-breeding initiative (30 min.) – Secretariat of the International Treaty

1 July

(9.00 – 9.30)

- Summary of findings of the first day and objectives of the second day - Secretariat of the International Treaty

(9.30 –11.00)

THIRD SESSION (CONT.)

- Potential Synergies between the Platform and the Benefit-Sharing Fund (30 min.) – Secretariat of the International Treaty; Mr Modesto Fernandez, Co-Chair of the AC-FS
- Embrapa’s proposal for an information sharing portal (30 min.) – Mr Ricardo Kobal Raski, Ministry of Agriculture, Livestock and Food Supply, Brazil
- The experience of the National Innovation Foundation of India with farmer-developed varieties (30 min.) – Mr Vipin Kumar, NIF
(11.00–11.30)

Coffee break

(11.30–15.30)

FOURTH SESSION: PRACTICAL MATTERS FOR THE FURTHER DEVELOPMENT AND FORMAL ESTABLISHMENT OF THE PLATFORM

- Possible institutional designs of the Platform, including for the participation of additional partners (30 min.) - presentation by the Secretariat of the International Treaty
- Discussion by participants (60 min.) - chaired by IAARD

(13.00–13.30)

Lunch

(13.30–15.30)

FOURTH SESSION (CONT.)

- Elaboration of road map by the Action Partners (120 min.) - chaired by IAARD

(15.30–16.00)

WRAP UP AND CONCLUSIONS

IAARD, Secretariat of the International Treaty
INTRODUCTION

Many plant genetic resources for food and agriculture have been exchanges among countries and have become major components of the diet in parts of the world outside their area of origin. No region is endowed with the same richness of plant genetic diversity, but some exhibit a much wider diversity than others. The interdependence among countries and regions in relation to plant genetic resources suggests that continuously conserving and utilizing PGRFA globally is extremely important.

The International Treaty on Plant genetic Resources for Food and Agriculture (ITPGRFA) is the only internationally agreed instrument governing conservation and sustainable use of agricultural crops, and the sharing of benefits that arise from their use, in order to ensure global long-term food security. The Treaty has created an innovative and unique instrument to address simultaneously several global challenges, including: the global food crisis, by ensuring that a global gene-pool of crops is accessible to all for breeding more high-yielding and productive varieties; climate change adaptation by conserving and pooling genes for tolerance to altered climatic conditions and by exchanging these genes for breeding higher stress-tolerance in varieties; biodiversity loss and genetic erosion in agriculture by conserving plant genetic diversity in the fields, on the farms, and in gene banks; and poverty alleviation and agricultural development for small-holder farmers through sharing with them the benefits arising from the use of genetic diversity which they have conserved over millennia.

One important pillar of the Treaty is a Funding Strategy including a Benefit-sharing Fund which supports projects and programs for the benefit of farmers in developing countries and countries with economies in transition. The Funding Strategy aims to enhance the availability, transparency, efficiency and effectiveness of the provision of financial resources for the implementation of the Treaty. The Benefit-sharing Fund is the mechanism of the Multilateral System (MLS) which implements commercial benefit-sharing for the genetic resources in the Treaty Gene-pool. The MLS sets out four primary benefit-sharing mechanisms, i.e., (1) exchange of information relating to plant genetic resources; (2) access to and transfer of technology; (3) capacity building for conservation and sustainable use for plant genetic resources; and (4) sharing of benefits arising from commercialization of plant genetic resources.

The Treaty calls for technology transfer as a form of non-monetary benefit-sharing, backed by information exchange and capacity-building. The Treaty provides that transfer of technology to countries shall be carried out through all types of partnership in research and development. Priority is given to the implementation of agreed plans and programs for farmers in developing countries who conserve and sustainably utilize plant genetic resources for food and agriculture. The Treaty’s Governing Body, has called for Contracting Parties and other relevant stakeholders to explore innovative ways to realize effective technology transfer, emphasizing that technology transfer is required to enhance the capacity to use plant genetic resources for food and agriculture through plant breeding, including the utilization of modern tools, traditional varieties and the participation of farmers.

In order to develop an effective platform for technology transfer, as a non-monetary benefit sharing of the Treaty, we need to identify the technologies needed by farmers, and analyze the
gaps in the technology application at farmers’ field with the availability of technologies at national and international research organization. To be relevance with objective of the Treaty, the technologies should be related to or in support of the conservation and sustainable use of plant genetic resources to face the climate change and to ensure food security. To get better understanding on the analysis, we also provide the country profile in agriculture sector as the background. It is hoped that this paper could trigger further discussion and could be extended to the cases in other developing countries.

**Indonesian agriculture’s profile**

Indonesia is a widespread archipelago of 17,500 islands located along the equator in Southeast Asia, with a diverse tropical environment and plentiful annual precipitation. Located along the “ring of fire” the nation is home to the most active volcanic islands in the world (Java and Bali). The volcanic origin of the archipelago provided vast areas of fertile soils which support both dense tropical rainforest and agriculture. Average annual rainfall in the country is roughly 3,175 millimeters (125 inches), but can exceed 6,100 millimeters (240 inches) in the mountainous highlands. The combination of copious rainfall and fertile soils make many areas of the islands ideally suited for farming. Total agricultural land in 2010 was estimated at roughly 40.7 million hectares, or 22 percent of the total land area in the country. The major crops produced in Indonesia include, but are not limited to, rice, palm oil, sugarcane, cassava, coconuts, corn, bananas, rubber, mangoes, oranges, chilies, sweet potatoes, soybeans, and peanuts.

The agricultural environment in Indonesia is divided largely by geography and altitude, with intensive food crop production occurring on the inner islands (Java, Bali, Lombok and Madura) while less-intensive perennial cropping systems (estate crops of oil palm, sugar, rubber, cocoa, coffee, tea) predominate on the outer islands of Sumatra, Kalimantan Sulawesi, and Papua. Natural soil fertility is highest on the inner islands, while lower-fertility acid soils predominate on the outer islands. This is a relic of the geologic parent material for the soils and the degree of weathering they have been subject to over the millennia.

Agriculture sector plays strategic role in Indonesian Economic Development. Besides providing food for Indonesian population, which in 2012 reach 241 million with annual growth rate 1.49%, agriculture also contribute to the capital formation, industrial raw materials and bio-energy provision, foreign exchange generation, work opportunities, and environmental conservation through the adoption of environmental-friendly technologies. The indirect impact of agriculture comes from its multiplier effects as the consequences of the interrelationships among industrial inputs and outputs, consumption, and investments.

Agriculture development in Indonesia, however, is still faced with many challenges. The production of some basic food sources such as rice, soybean, maize, beef-cattle and sugarcane should keep pace with the population growth, which expected to reach 300 million in 2020. The climate change will hamper the effort to increase food production and might endanger food security. Food production will also have to compete with production of bio-energy raw materials both in land-uses and the use of food crops as bio-fuel. There is also a need to diversify the food, not only to reduce the consumption of rice, but also to increase the consumption of functional food to have a healthier and balanced diet for Indonesian people. This diet change happened as the improvement of income and might change the strategy in increasing food production, food product development and agriculture development in general.

**Agro-ecosystem**

An agro-ecosystem is an ecosystem under agricultural management. It differs from natural ecosystems in that the energy flows, nutrient budget and biodiversity are subject to human intervention. In fact, the human intervention in term of the choice of crops, technologies, and the farming system are the main factor that delineate one agro-ecosystem to the others. Major agro-
ecosystem in Indonesia such as lowland, upland, and tidal swampland, are delineated not only based on the elevation, but also based on the methods of rice cultivation.

The lowland, an area of land that is not very high above the sea or that is lower than most of land around it. The lowland farming systems, with rice as the single crop, provides the staple food for the ever-growing population of Indonesia. Lowland farming is a source of food, wealth and job opportunities for most of the Indonesian people living in rural areas. Irrigated lowland is the most appropriate system in terms of sustainability and year-to-year yield stability. High rates of fertilizer use and improved crop protection practices have contributed to the high yields of rice.

There is no statutory definition of ‘uplands’, but it is generally accepted to refer to areas of mountain, moor and heath, high ground above the upper limits of enclosed farmland, largely covered by dry and wet dwarf shrub heath species and rough grassland. Hill farms also have adjacent land in the form of semi-improved and improved grassland that are used in conjunction with the moorland and rough grazing. All of this land needs to be sustainably managed in order to safeguard the valuable biodiversity of the plants and animals that can only thrive in these habitats. Upland farming is practiced mostly under rain-fed conditions in the outer islands. Upland soils are dominated by highly weathered acid soils, Ultisols, Oxisols and Inceptisols, whose phosphorus deficiency is usually a major constraint to crop production. Upland areas are abundant in the country and have a high potential for agricultural development.

Tidal swampland is the area near the coastal region influenced by sea-tides. Swampland are classified as type A, if they are directly influenced sea-tides and flooded during spring and neap tides; type B, if they are directly influenced by sea tides but flooded only during spring tides; type C if they are influenced by sea-tides only through water infiltration in the soil; and type D if they are not affected by sea-tides at all. Rice is the traditional crops in tidal swampland. Other crops such as soybean, maize and vegetables can be cultivated in tidal swampland of type B. land construction, i.e., by making raised-bed land will enable fruit crops such as citrus, mango and rambutan to be cultivated.

**Priority crops for technology transfer**

The crops are prioritized based on several factors. Although the Treaty covers any plant genetic resources, it is reasonable if, at this stage, we consider only the crops that included in Annex 1 of the Treaty. This is because; technology transfer in most cases involves the transfer of genetic materials. The crops that has been included in Annex 1, is easily to be transferred among contracting parties through the Multilateral System. The second consideration for prioritizing the crops is the involvement of small-scale farmers in their cultivations. At the next step we pick the crops that fulfilled the above requirement, based on specific consideration, i.e., national priority, its role in farmers’ income, food diversification, and nutrition value. Rice and maize are two of the four crops on national priority. Although alfalfa is not on national priority, its role as feed crops will support the national target on beef-cattle self-sufficiency. Coconut, banana and citrus was chosen because of its role in farmers’ income; whereas tomato and yard-long bean was chosen based on its nutritional value and the fact that its wide-spread use as complement on Indonesian dishes. The potato and wheat were chosen because of its continuing increase in consumption as the impact of the change in dietary toward western-style food. The final crop in the list is Taro, which is a source of carbohydrate, but still underutilized. The brief descriptions of the priority crops are given below.

**Rice**

Rice is by far the most important food crop grown in the country today, with cultivated area is 12.2 million hectares in 2011, with harvested area was 13.4 million hectares in 2012, accounting for 30 percent of total agricultural land. Accounting average national productivity 5.1 ton/ha, therefore the rice production was 69 million ton dry paddy grain in 2012. The amount of rice production was over domestic demand with self sufficiency index 116%. Rice is grown by approximately 77 percent of all farmers in the country (25.9 million) under predominantly
subsistence conditions. The average farm size is very small at less than 1 hectare, with the majority of farmers cultivating landholdings between 0.1 - 0.5 hectares in size. Rice production is heavily concentrated on the islands of Java and Sumatra, with nearly 60 percent of total production emanating from Java alone. Java is the most densely populated island in the world and home to nearly 60 percent of the nation’s population (approximately 143.8 million). Given the highly concentrated human population, there is intense competition for land and pressure to intensify the cultivation cycle and enhance the productivity of whatever food crop is being produced. Java, therefore, is also the focus of the country’s rice research and development efforts, as agricultural scientists search for the next breakthrough in high-yielding varieties and improved farming systems. As a result, improvement of rice variety is designed to meet Java consumer preference in the big portion. The variety improvement is not only conducted by breeding but also by purifying local line which is widely planted by farmers.

**Maize**

Maize is the second important cereal crop in Indonesia. The domestic production increased by approximately 4.1% annually during the past 30 years. Harvested area of maize in 2012 was 3.96 million ha, with average national productivity 4.9 ton/ha therefore national maize production was 19.37 million ton grain. The amount of maize production was over domestic demand with self-sufficiency index 117%. The growing monthly demand especially for the rapidly growing feed grain sector industry cannot be met by domestic production. During the off-season crop, demand of maize for feed industry usually covered by import. Maize is widely planted as inter-crop with rice mainly in lowland and to some extent in the rain-fed, upland and tidal swamp agro-ecosystem. The currently recorded average maize yields in comparison to climatic-genetic yield potential indicate that there is a large scope for further increasing the maize production by closing this yield gap. Maize productivity is increasing by adoption of hybrid maize. The maize variety improvement for food is not only conducted by breeding but also by purifying local composite line which is widely planted by farmers. However, the maize production systems in Indonesia vary depending on agro-ecological and socio-economic conditions.

**Coconut**

As a tropical country, Indonesia is a fertile land for coconut palms. The lowlands of its coastal areas from Sumatra in the west and Papua in the east are lined with the swaying slim tall plants. However, this potential has not sufficiently attracted enough big investors to produce major export commodity from coconut palms like oil palm, coffee and cocoa. Currently, there are 3.8 million hectares of coconut plantations expanding from 1.66 million hectares in 1969. The vast majority of the plantations (98% or 3.7 million hectares) are owned by smallholder farmers. Plantations owned by state or private companies are around 4,669 hectares. Most of the plantations, owned by farmers are left to grow naturally without proper management and remain small, below the commercial scale. The productivity has therefore been very low, only around 1 t copra/ha/year, below its potential which could reach 2.6-3.4 t copra/ha/year, using improved local varieties. Besides that, a number of pests and diseases such as *Oryctes rhinoceros*, *Brontispa*, Kalimantan wilt caused by *Ptytoplasma* and bud rot and immature nut fall caused by *Phytophthora palmivora* Buttler have caused coconut production become even lower.

**Alfalfa**

As Indonesia targeted to be a self-sufficiency country in beef-cattle production, the availability of good quality forage is very important. Alfalfa (*Medicago sativa* L) or Lucerne is a perennial herbaceous legume with superior forage quality. It is the most important forage crop in the world and it was the first domesticated forage crop. Alfalfa is able to fix nitrogen from the air through a symbiotic relationship with *Rhizobium* bacteria with N production 7.85 –10.37 g/m2.Its rooting system can reach 4.5m that allows it to escape drought. Forage production can reach 15.48 tons of dry matter per ha/year and containing 18.0 –29.1 % crude protein. Alfalfa plants can live 3 to 12 years depending on climatic conditions and crop varieties. Alfalfa is not a tropical plant, thus it has not been widely cultivated in Indonesia. The crop has been introduced to Indonesia since 2004.
Potato

Potato (*Solanum tuberosum* L.) is one of the most important crops of the horticultural subsector in Indonesia. Potato production in Indonesia has increased significantly in the last 4 years from 1,176,304 ton in 2009 to 10,687,998 ton in 2012 (BPS, 2013). Indonesia is also the largest potato producer in Southeast Asia and only second after China among the priority countries in the International Potato Center – East, Southeast Asia and the Pacific (CIP-ESEAP) region. Potato production is dominated by small-scale farmers who are dispersed over highland areas at about 1200 meters above sea level. The potato has been given high priority in vegetable research in Indonesia, because of its potential as alternative carbohydrate source in food diversification and export markets. The main potato variety in Indonesia since the 1980’s is Granola which covers 80 to 85% of the potato area. Late blight and bacterial wilt are the most important diseases followed by viruses. Seed is the most costly component of potato production, and potato profitability often depends on access to quality seed. Seed accounts for 10-20% of the total costs of potato production.

Banana

Banana is the most important and widely planted fruit in Indonesia, 6,071,043 tons (BPS, 2012). Banana has the highest production rate among all fruit crops. Major banana production areas are found in Java (54%), contributing to 68% of national banana production, while large potential lands are available in Sumatera, Kalimantan, Sulawesi and Papua. Mostly, banana is planted as a backyard crop or mixed with other crops such as cassava, coconut and other perennial fruit trees with minimum input management.

Citrus

Citrus fruit is very important to the Indonesian farmer, since it can give them more income than other crops. They can get at least five to six times as much income from a 5-6- year-old citrus planting as from groundnut and four to five times as much as from rice cultivated on equal acreages. Because of good yields and prices for certain mandarin varieties, more and more acreage is being planted. It is estimated that the harvested area of citrus in Indonesia is 57,083,000 ha with production in 2010 amounting to 1,818,949 (Pusdatin, 2013). Except in some places, i.e., the southern part of West Java and the northern part of West Borneo, mandarin trees are not planted as special citrus orchards, but are usually mixed together with other crops. Citrus plantings are scattered throughout the larger islands of Sumatra, Java, Madura, Borneo, Sulawesi, Bali, Lombok, etc.

Tomato

Tomato is one of the most economically important vegetable crops in the world. In Indonesia and, it is an ingredient in many dishes and is a good source of vitamins and other nutrients. Tomato production is dominated by small-scale farmers who favor this crop for its relatively high cash value which contributes significantly to their income.

Tomato yields in Indonesia are below the world average, in part due to the damage caused by three tomato viruses: the white fly-transmitted Gemini virus (Tomato Leaf Curl Virus (ToLCV), Tomato Yellow Leaf Curl Virus (TYLCV)) and the Cucumber Mosaic Virus (CMV). Infections by these viruses result in 50 to 100% yield reduction, threatening the livelihoods of small-scale tomato farmers.

Yard long bean

Yard long beans (*Vigna Sesquipedalis*) are a climbing member of the Fabaceae. They are close relatives of the cowpea, which have shorter pods and do not climb. Yard-long beans, as the name suggests, differ from cowpeas in their very slender long green beans, which have a beautifully delicate flavour. Other names for yard-long beans include chori (Hindi), bora (Caribbean) and snake bean. Yard long bean is a dry season tropical crop, which favours hot temperatures. They can be grown similar to runner beans, up poles made into wigwams in groups of 6 or 8 plants. Plants twine anticlockwise and will climb as tall as runner beans. Water plants in thoroughly after
transplanting, but subsequently, don’t over-water, as they are used to growing under dry conditions. They will benefit from a light dressing of garden or green waste compost before transplanting but should not be grown in a soil over-rich in nitrogen. Yard long beans are not troubled by too many pests and diseases, but may develop low levels of red spider mite if conditions are very hot and dry.

Taro

Taro (Colocasia esculenta(L.) Schott) is an important tuber crop grown widely in humid tropics and a source of carbohydrate for many people in Asia, Africa, and the Pacific islands. FAO data recorded that taro area is about 1.4 million ha with a yield of 8.3 million ton per year in the world. In Indonesia, data recorded taro center areas such as West Papua province with 21,952 ha, and two districts of Mentawai islands with 176 ha and with poor yield (2.5–3.4 ton/ha). This crop has particular potential for marshy, water-logged, coastal, and salty regions, where it could help overcome food shortage. Taro tuber/corm is a source of carbohydrate used as staple food or snack; taro flour can be produced for soups, biscuits, bread, beverages, and puddings. The leaves and stalks of taro are used as vegetable, as they contain a high protein that is useful for people diet in developing countries. The taro leaf contains 87.2% water, 3.0% protein, 0.8% fat, 6.0% carbohydrate, 1.4% fiber, 1.6% ash, and is an excellent source of vitamin C.

Wheat

The high rainfall and hot, humid environments in Indonesia are not considered favorable for wheat production. The domestic demand for wheat, however, remains high. It is met entirely by imports and requires substantial foreign exchange. Recent advances in technologies for wheat production in humid tropical environments have prompted Indonesia to initiate research to develop technologies for domestic production of wheat. Several varietal trials have indicated that, under appropriate soil and climatic conditions, wheat can be produced economically. An evaluation of climatic conditions indicates that temperatures that will allow wheat to grow occur in the Indonesian highlands 350 meters above sea level (masl) and above. Multi-location trials indicate a linear increase in wheat yield with increasing elevation, if there is no damage from pests and diseases and if appropriate planting times are chosen. Surveys indicate a potential land area of 31 million hectares where wheat production may be possible. Soil acidity and infertility, however, present a serious challenge. Fertile, nonacid soils occur at elevations of 700 to 1000 masl, but these areas are exclusively devoted to high value vegetable and fruit crops. Wheat will, therefore, have to be developed for lower elevations where soil management technologies will need to address the problems of soil acidity and infertility. A comparison of rainfall patterns and duration of dry seasons indicates that the eastern part of Indonesia may present a better environment for wheat production. Indonesia has initiated breeding for tropical wheat adaptive to 350 meters above sea level (masl) since 2009. Some promising line have identified with productivity over 1.5 ton/ha.

Gaps in technology applications

To determine the need and methods of technology transfers we should identify the gaps between technologies applied at farmers’ field, and the technologies available at national or international technology sources. The gaps between the technology applied at farmers’ field and the technology available at national sources will be used to determine method of extension and technology dissemination; whereas the gaps between the technologies available at the national and international sources will be used to determine the need for licensing, material transfer, training and exchanges of information or co-development of technologies.

Considering the wide range of crops and the technologies, we will focus only on the prioritized crops and the technologies that support the conservation and sustainable use of such crops genetic resources. These technologies can be classified into 3 categories:
1. New crops varieties resulted from conventional breeding or biotechnology that are high-yielding, resistant to biotic and non-biotic stress or match with farmers’ specific need; or Plant genetic materials containing genes that control certain traits needed to develop such crops varieties.
2. Value addition and genetic improvement of underutilized crops.
3. Cultural practices, including pests and diseases control, for maintaining ex-situ and in situ collection of the crops and their wild relative.

The main technology source at national level is the Indonesian Agency for Agricultural research and Development (IAARD) with its 12 research centers. Other sources are Universities and research centers under the ministry of Sciences and technology. Some farmers have or created indigenous knowledge that also become the source of technology. At the international level the technology sources are international research organization, national research centers from different countries, universities or private sectors.

**Technology needed by farmers**

The technologies needed by farmers are listed in the last column of Table 1. It might differ with the available technologies at the national or international technology sources, which may prompted the need for co-development of such technologies. In most cases, however, the technologies needed by farmers are the same with the technologies available at the national and international sources. It should be noted that the technologies needed by farmers are determined through discussion with researchers and extension workers. So there might be a bias in technologies identification toward the view of researchers or extension workers.

Most of the technologies identified are of category 1, i.e. new crops varieties resulted from conventional breeding or biotechnology that are high-yielding, resistant to biotic and non-biotic stress or match with farmers’ specific need; or Plant genetic materials containing genes that control certain traits needed to develop such crops varieties. In rice, the technologies are different for different agro-ecosystem. At irrigated and rain-fed lowland agro-ecosystem, most farmers have already use high-yielding varieties, however, damage due to some pest and still become the problem. Farmers need varieties that in addition to high yielding are also resistant to stem-borer.

In addition to varieties or genetic materials, controlling pest and diseases is also the technologies most needed by farmers. This is particularly important for horticultural crops such as banana, citrus, tomato, potato and long-year bean, where damage due to pest and disease could substantially reduce production.
Table 1. Gaps in technology application and technologies needed by farmers for conservation and sustainable use of plant genetic resources.

<table>
<thead>
<tr>
<th>No</th>
<th>crops</th>
<th>Agro-ecosystem</th>
<th>Technology used by farmers</th>
<th>Technology available in the country</th>
<th>Technology available from international sources</th>
<th>Technologies needed by farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rice</td>
<td>Irrigated Lowland</td>
<td>Improved inbred varieties; medium duration; susceptible to stem borer</td>
<td>• Conventional and irradiation breeding for high yielding, short- medium duration and resistant to biotic or a-biotic stress • Hybrid rice</td>
<td>Resistance to certain pest &amp; disease</td>
<td>Brown plant-hopper, stem borer, tungro, blast, bacterial blight resistance,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rainfed lowland</td>
<td>Improved inbred varieties</td>
<td>Short to medium duration</td>
<td>Resistant to certain pest and diseases</td>
<td>Stem borer resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upland</td>
<td>Purified Local varieties</td>
<td>Short to medium duration</td>
<td>Blast resistance</td>
<td>Blast resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tidal swampland</td>
<td>Local varieties; low yielding; tolerance to biotic stress; long duration</td>
<td>Medium duration; relatively high yielding</td>
<td>Short duration</td>
<td>Submergence tolerance</td>
</tr>
<tr>
<td>2</td>
<td>Maize</td>
<td>Dry-land</td>
<td>Local varieties; susceptible to drought; Short duration low- yielding.</td>
<td>• High yielding variety responsive to fertilizer; short-medium duration and resistant to biotic or a-biotic stress • Hybrid maize</td>
<td>High yielding variety, tolerance to drought</td>
<td>High yielding variety, short duration; tolerance to drought and pest and diseases.</td>
</tr>
<tr>
<td>3</td>
<td>Coconut</td>
<td>Dry-land</td>
<td>Tall and Dwarf local Varieties</td>
<td>Tall and Dwarf local Varieties</td>
<td>Improved varieties Dwarf-high</td>
<td>Improve high yield, big fruit and dwarf varieties</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yield, big fruit</td>
<td>Resistance to bud rot</td>
<td>Resistance to immature-nut fall</td>
<td>Resistance to Kalimantan Wilt (lethal yellowing)</td>
<td></td>
</tr>
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</tr>
<tr>
<td>4</td>
<td>Alfalfa</td>
<td>highland, untolerance to to the pests in Indonesian tropics</td>
<td>Low forrage production in highland</td>
<td>Not available, need to be introduced from other countries</td>
<td>Seedstock that adapted to Low-dryland, low rainfall (max 4 m of rainfall days and &lt; 750 mm per year), tolerance to high intensity of photoperiod, limited water availability, tolerance to pests</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Potato</td>
<td>Medium to highland.</td>
<td>New superior high productivity varieties; Pest and disease control; Selected seedlings; High agrochemical application; Traditional postharvest handling</td>
<td>High yielding varieties; Integrated crop management</td>
<td>New varieties adapted in the medium areas</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Banana</td>
<td>Low, medium, and highland areas</td>
<td>Fusarium wilt disease control</td>
<td>Integrated pest management</td>
<td>Control technology of fusaria wild disease</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Citrus</td>
<td>Lowland, medium, and highland</td>
<td>CVPD disease control; Fertilizer application</td>
<td>Integrated pest management; Integrated crop management</td>
<td>Control technology of CVPD</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Tomato</td>
<td>Lowland area, medium, and highland area</td>
<td>Pest and disease control</td>
<td>Integrated pest management</td>
<td>Control technology of bacterial wilt disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crop</td>
<td>Area</td>
<td>Variety Details</td>
<td>Pest and disease control</td>
<td>PM and ICM</td>
<td>Integrated crop management</td>
</tr>
<tr>
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<tr>
<td>9</td>
<td>Yard long bean</td>
<td>Lowland</td>
<td>Pest and disease control</td>
<td>PM and ICM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Taro</td>
<td>Lowland/SAWMP area</td>
<td>Local varieties with itchy</td>
<td>Not available</td>
<td>Non-Itchy varieties from Vanuatu</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Wheat</td>
<td>Tropical dry land area</td>
<td>Not available</td>
<td>Introduced lines for highland and lowland Conventional, irradiation, somatic embryogenesis and transgenic crop for tropical wheat adaptive to elevation 350 meter above sea level</td>
<td>High temperature tolerance, disease tolerance</td>
<td></td>
</tr>
</tbody>
</table>
SECOND MEETING OF THE PLATFORM FOR THE CO-DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

Bandung, Indonesia, 30 June-1 July 2013

CO-DEVELOPMENT AND TRANSFER OF TECHNOLOGIES: AN ASSESSMENT OF NEEDS EXPRESSED UNDER THE FIRST TWO FUNDING CYCLES OF THE BENEFIT-SHARING FUND

EXECUTIVE SUMMARY

The present document is one of several analytical papers that were requested by the action partners of the Platform for the Co-development and Transfer of Technologies (hereinafter ‘Platform’), to structure the discussions of their second meeting.

The establishment of the Platform was recommended in the Rio Six-point Action Plan for the International Treaty, which was adopted by a High-level Round Table at the United Nations Conference on Sustainable Development (“Rio+20”, Rio de Janeiro, Brazil, June 2012), to promote the transfer of technologies for the conservation and sustainable use of plant genetic resources for food and agriculture (PGRFA).

Technology transfer has an important role in the implementation of the International Treaty on Plant Genetic Resources for Food and Agriculture (hereinafter ‘Treaty’), both as an element of the funding priorities of the Benefit-sharing Fund of the Treaty’s Funding Strategy and as a form of non-monetary benefit-sharing under the Treaty.

At their first meeting, the Platform action partners decided to create “technology transfer packets”, with the objective of providing “one-stop-solutions” to the expressed needs of the target communities and the end users. They also noted that, in the context of the Treaty, end users of technology for the conservation and sustainable use of PGRFA are mainly farming communities in developing countries.

Consequently, this paper analyzes the needs and demands regarding co-development and transfer of technologies (hereinafter ‘technology needs’) that were expressed in the project proposals submitted by applicants in response to the first two calls for proposals of the Benefit-sharing Fund.

The technologies demanded by applicants to the Benefit-sharing Fund are mainly linked to the availability, development and conservation of PGRFA, as well as to a set of related training and awareness raising activities. A particular need was expressed with regard to technologies for the characterization, evaluation and documentation of collected local varieties and other ex situ held material, especially for the identification of climate change resistant varieties and traits. Equally, technologies to enhance the distribution of locally adapted varieties to farmers, including through
seed multiplication, re-introduction of *ex situ* material, seed fairs and community seed production, figured very high on the demands of applicants.

Based on a systematic analysis of the technology needs expressed, the paper proposes two "technology needs clusters", which the Platform action partners may consider as a starting point for the task of structuring technology transfer packets:

1) Co-development of locally adapted crop varieties and related technologies

2) Dissemination of agricultural technologies to respond to local needs
1. INTRODUCTION

1.1. RATIONALE

The Treaty is a legally binding instrument with the objective to promote the conservation and the sustainable use of crop diversity, and to share the benefits that arise from the use of PGRFA in a fair and equitable manner, for sustainable agriculture and food security.\(^8\)

The Treaty provides for both monetary and non-monetary sharing of benefits. Monetary benefit-sharing is effected through the Benefit-sharing Fund—a multilateral financial mechanism that invests in high impact projects that aim at helping farmers adapt to climate change through conservation and sustainable use of crop diversity. Two project portfolios have already been implemented, and the launch of the third call for proposals—with a size of approximately US$ 7.5 million—is scheduled for 2013. Technology transfer is an element of the funding priorities for the use of the resources of the Benefit-sharing Fund, and the third call for proposals will have a particular funding window for co-development and transfer of technologies.\(^9\)

Access to and transfer of technology is also a form of non-monetary benefit-sharing under the Treaty. The Treaty refers in particular to “technologies for the conservation, characterization, evaluation and use” of PGRFA and, recognizing that “some technologies can only be transferred through genetic material”, underlines the need for facilitated access to “these technologies, improved varieties and genetic material”. The Treaty further provides that access to and transfer of technology to countries shall be carried out, \textit{inter alia}, through partnerships in research and development.\(^10\)

The Treaty’s Governing Body has repeatedly called for Contracting Parties and other relevant stakeholders to explore innovative ways to realize effective technology transfer in order to enhance the capacity to use PGRFA through plant breeding, including the utilization of modern tools, traditional varieties, and with the participation of farmers.\(^11\)

At the United Nations Conference on Sustainable Development, a High-level Round Table convened by the Governments of Brazil, Indonesia and Norway, adopted the Rio Six-point Action Plan for the International Treaty. This plan recommended, as a priority, that stakeholders of the Treaty “establish a Platform for the Co-Development and Transfer of Technologies”.

A group of national and international institutions with skills and experience in agricultural technologies (hereafter ‘action partners’) met on 7-8 August 2012 in Brasilia, Brazil, to engage in initial discussions as to how to establish the Platform within the Funding Strategy of the Treaty. The present document is one of several analytical papers that were requested by the action partners, to structure their discussions at their second meeting.

1.2. NATURE AND SCOPE

There was an agreement among the action partners of the Platform at their first meeting that technology is generally transferred in the context of a packet of activities, which often also includes information exchange and capacity building, as well as policy and infrastructural support. Therefore, a coherent approach to proactive technology transfer could be sought by bringing together a variety of activities by a number of actors, in order to create “technology transfer packets”, with the objective of providing “one-stop shop” solutions to the expressed

\(^8\) International Treaty on Plant Genetic Resources for Food and Agriculture (2001), Article 1.

\(^9\) The priorities of the Benefit-sharing Fund are: information exchange, technology transfer and capacity building; on-farm management and conservation of PGRFA; and sustainable use of PGRFA.


needs of the target communities and end users.

It is for this reason that this paper adopts a demand-driven approach in identifying technology needs related to PGRFA. More than 80 project proposals received by the Treaty Secretariat in response to the first two calls for proposals of the Benefit-sharing Fund were thoroughly analyzed, to identify the technology needs expressed therein. This includes the 11 projects that were funded under the first round of the project cycle, the 11 immediate action projects that were funded under the second cycle, plus all the full project proposals submitted under the funding window for immediate action projects that were not selected for funding. The paper’s focus on the Benefit-sharing Fund answers to the Platform’s aim of responding to needs identified by target beneficiaries.

Taking into account the principles agreed upon by the action partners at their first meeting, the term technology is understood in a very wide sense for the purposes of this paper. The analysis of the project proposals therefore considered both “hard technologies” such as seeds and propagating material, infrastructure and equipment; and “soft technologies” including knowledge of methods, techniques and practices; as well as organizational structures, strategies, programmes and policies that are conducive to the development, enhancement and exchange of technologies. This wide understanding of the term technology is also in line with Background Study Paper No. 30 of the FAO Commission on Genetic Resources for Food and Agriculture, which proposes an inventory of options for non-monetary benefit-sharing under the Treaty.

It should be noted, however, that despite this wide understanding of the term technology, the technology needs expressed through the project proposals of the Benefit-sharing Fund cover only a subset of the totality of technologies related to PGRFA. This is due to the fact that applicants formulated their project proposals in response to specific calls for proposals and in accordance with the eligibility criteria and priorities of the Benefit-sharing Fund.

The priorities of the Benefit-sharing Fund are: information exchange, technology transfer and capacity building; on-farm management and conservation of PGRFA; and sustainable use of PGRFA. Building on these priorities, the second call for proposals adopted the thematic focus “to assist farmers to adapt to climate change through a targeted set of high impact activities on the conservation and sustainable use of plant genetic resources for food and agriculture”. Correspondingly, the technology needs that are found in the project proposals focus primarily on technologies to promote the sustainable use and the on-farm management and conservation of PGRFA, which benefit farming communities in developing countries.

2. ANALYSIS OF THE TECHNOLOGY NEEDS EXPRESSED THROUGH THE BENEFIT-SHARING FUND

In order to obtain a clear picture of the technology needs expressed through the Benefit-sharing Fund, the project proposals submitted in response to the first two calls for proposals were screened for technologies being demanded and/or proposed to be developed, used and/or transferred by applicants. To allow for a systematic analysis, the various technology needs identified were in a first step grouped into the following four broad and interrelated categories, which the action partners may consider as possible components of the technology transfer packets:

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12 Technology can be understood as the means and tools for problem solving. While “hard technology” refers to the physical entities through which operations are conducted (tangible phenomena), “soft technology” refers to entities without physical form and embodied process (intangible phenomena).

13 Available at: ftp://ftp.fao.org/docrep/fao/meeting/014/j6639e.pdf

14 According to the eligibility criteria, projects of the Benefit-sharing Fund must benefit Contracting Parties that are developing countries. In addition, Article 13.3 of the Treaty states that benefits should flow primarily to farmers who conserve and sustainably use PGRFA.
Seeds and propagating material: most importantly, virtually all project proposals expressed the need for locally adapted, high yielding and climate change resistant varieties, both local and improved. In this context, they focussed on technologies, techniques and practices to develop and enhance the availability of such varieties, and to promote the conservation and management of all PGRFA, including crop wild relatives (CWR):

- **PGRFA development**: most project proposals expressed the need to adopt technologies for the selection and development of PGRFA. Participatory approaches like participatory variety selection (PVS) and participatory plant breeding (PPB) were put forward in particular, but also other breeding techniques including marker assisted selection and those related to pre-breeding.

- **Seed availability**: a general need for both formal and informal systems for seed multiplication and distribution was expressed, including through community level agricultural fairs and seed fairs.

- **PGRFA conservation and management**: project proposals expressed the need to collect local varieties and CWR; to conserve collected PGRFA ex situ in community seed banks and in national and international gene banks, including using cryopreservation and in vitro conservation techniques; and to conserve and manage local varieties and CWR on-farm, including re-introduced ex situ material.

**Knowledge**: most project proposals expressed the need for information and knowledge related to PGRFA. In general, they emphasized the need for increased research, capacity building and awareness raising activities:

- **PGRFA research**: a majority of applicants proposed to carry out surveys to locate local varieties and CWR; promote characterization and evaluation for high yields and climate change resistance, including through on-farm evaluations with farmer participation, on-station trials and molecular characterization; documentation of farmers’ and indigenous communities’ traditional knowledge related to PGRFA, including local climate change adaptation strategies, seed selection and storage practices; and market research with the aim of finding niches for local produce.

- **Capacity building on technologies**: needs expressed in the project proposals include training in several of the technologies, techniques and practices contained in the category “seeds and propagating material”, such as on-farm conservation and management practices, PVS and PBB, and seed production. In addition, there is a need for training in cultivation practices, particularly sustainable intensification and diversification of farming practices such as integrated pest management and conservation agriculture, and for value addition through product processing.

- **Awareness raising related to PGRFA**: many applicants expressed the need of sharing information on the importance of PGRFA, in particular for food security and climate change adaptation, including through information and communication materials.

**Organizational structures, strategies, programmes and policies**: many project proposals expressed the need to strengthen formal and informal seed systems, in particular by:

- **Creating partnerships and linkages**: creating farmer groups and networks for on-farm conservation, seed multiplication and exchanges of PGRFA and knowledge; and by linking the different stakeholder groups of the seed chain, including farmer breeders, public and private sector breeders, researchers, national gene banks and community seed banks.

- **Strengthening planning and policy**: they also expressed the need for developing and strengthening legal and policy frameworks for sustainable use and on-farm conservation and management of PGRFA in relation to food security and climate change adaptation,
and underlined the necessity to involve all relevant stakeholders, especially farmers, in all project activities.

Infrastructure and equipment: needs with regard to infrastructure and equipment relate in particular to seed storage, supply and conservation facilities; information technologies; and basic agricultural infrastructure and equipment.

- Community level infrastructure: Many applicants proposed to establish or improve community seed banks for local storage, but also as hubs for participatory evaluation and distribution of PGRFA, nurseries for the multiplication of propagating material, and demonstrative units for comparative trials and participatory evaluation. In this context, some applicants proposed to provide farming communities with basic agricultural infrastructure and equipment such as irrigation facilities, greenhouses and tools.

- Gene bank and information infrastructure: some project proposals also conveyed the necessity to modernize gene banks, including by introducing in vitro technology. Several project proposals expressed the need for electronic databases containing evaluation and characterization data on PGRFA.

It is important to note that the above technology categories are highly interlinked and not mutually exclusive. In fact, all of the project proposals expressed a variety of technology needs, in each case covering two or more categories. Categorizing the technology needs in this way allowed to identify the most pressing ones by weighing them according to the number of project proposals in which they were expressed. An overview of this analysis is illustrated in the annex to this paper.

In a second step, two cross-category “technology needs clusters” were defined, by linking the identified pressing technology needs across the four categories. These clusters are presented in the subsequent two sections of this chapter. The Platform action partners may consider them as a starting point for the task of structuring technology transfer packets.

2.1. CO-DEVELOPMENT OF LOCALLY ADAPTED CROP VARIETIES AND RELATED TECHNOLOGIES

This technology needs cluster focuses on the transfer and use of seeds and propagating material and related technologies for research and breeding activities. This includes activities that are directly linked to breeding, such as surveying local crop diversity; collecting local varieties and CWR and conserving them ex situ; characterization and evaluation of collected material to identify high yielding and climate change resistant varieties and traits; and documentation of traditional knowledge of farmers and indigenous communities. It also includes different types of breeding such as PVS and PPB, marker-assisted selection and pre-breeding, as well as training in such breeding techniques. Further, the cluster comprises technology needs related to infrastructure and equipment that support research and breeding activities, such as the modernization of gene banks and the establishment of PGRFA databases. Table 1 provides an overview of the proposed technology needs cluster.
Table 1: Technology Needs Cluster 1 – Co-development of locally adapted crop varieties and related technologies

<table>
<thead>
<tr>
<th><strong>surveying local crop diversity (incl. ecogeographic surveys)</strong></th>
<th><strong>collecting local varieties and CWR (incl. through field demonstrations, agricultural fairs and seed fairs)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ex situ conservation of collected material</strong> (incl. in community seed banks, national and international gene banks, inter alia through in vitro technology and cryopreservation)</td>
<td><strong>modernize gene banks</strong> (incl. laboratory and equipments for seed health testing and in vitro conservation)</td>
</tr>
<tr>
<td><strong>characterization and evaluation</strong> of collected material and other ex situ material for high yields and climate change resistance (incl. through GIS techniques, on-station trials, lab tests, farmer evaluation, on-farm evaluation, phenotypic evaluation, molecular characterization, morphological characterization, agronomic characterization)</td>
<td><strong>demonstrative units</strong> managed by farmers, for comparative trials, participatory evaluation, multiplication and exchange of PGRFA (incl. pilot sites, model farms and evaluation plots)</td>
</tr>
<tr>
<td><strong>documentation of traditional knowledge</strong> (incl. local cultivation practices, local climate change adaptation strategies, farmer criteria for variety selection, seed storage techniques, consumption patterns)</td>
<td><strong>electronic databases</strong> as a one-stop access point for evaluation and characterization data on PGRFA (incl. information on traditional knowledge and climate change adaptation strategies)</td>
</tr>
<tr>
<td><strong>training in PVS and PPB</strong> (incl. farmer seed selection, on-farm characterization and evaluation, community evaluation, training for trainers, participatory seed management)</td>
<td><strong>breeding locally adapted, high-yielding and climate change resistant varieties: PVS and PPB</strong> (incl. on-farm selection and observation trials), <strong>marker-assisted selection</strong> and <strong>pre-breeding</strong></td>
</tr>
</tbody>
</table>

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15 In addition, needs with regard to raising awareness on the importance of PGRFA for food security and climate change adaptation; linking different stakeholders of the seed chain; developing and strengthening legal and policy frameworks; and stakeholder involvement are relevant to both technology needs clusters and therefore not specifically mentioned in this overview. For more information on these items, please refer to the annex to this paper.
Box 1: On-farm Conservation and Mining of Local Durum and Bread Wheat Landraces of Morocco for Biotic Stresses and Incorporating UG99 resistance (an example from the Benefit-sharing Fund’s first project cycle)

The two main goals of this project were to broaden the genetic base of the wheat (*Triticum spp.*) collection held by the gene bank of the National Agricultural Research Institute (NARI) of Morocco, and to raise awareness of farmers in marginal areas on the importance of on-farm conservation and management of local varieties.

Two collecting missions were carried out in three agro-ecological zones. Through direct dialogue with farmers and vendors at local markets, as well as searching threshing areas and fields covered with improved varieties, the NARI scientists managed to collect 34 accessions of local wheat varieties for safeguarding in the national gene bank.

Further, the project promoted on-farm trials at three different sites, with the participation of farmers, scientists from the NARI and government officials from the Ministry of Agriculture. These on-farm trials involved 122 local varieties of wheat, including the 34 accessions that were collected in the framework of the project and others that had already been collected previously, as well as some improved cultivars that were used as checks. An analysis showed that most of the 35 accessions selected by farmers according to their own criteria corresponded to the ones chosen by the scientists. The farmer selected accessions where subsequently evaluated and characterized, revealing that some of them exhibited even higher resistance levels to biotic stresses than the ones the scientists had chosen.

In total, the Benefit-sharing Fund contributed to ongoing activities that brought about the characterization for biotic stresses of 317 accessions of local wheat varieties, identifying 96 accessions that are immune to leaf rust (*Puccinia recondita* f. sp. *tritici* (Eriksson & Henning) Henderson), 25 immune to yellow rust (*Puccinia striiformis* Westend), and four accessions that have a good level of resistance to both stem rust (*Puccinia graminis* f. sp. *tritici* Eriksson & Henning) and yellow rust. Given the transboundary nature of these diseases, the project findings are of particular importance to neighbouring countries and other countries where the diseases prevail.

Finally, the NARI scientists identified the best three accessions for both durum wheat (*Triticum durum*) and bread wheat (*Triticum aestivum*) from among the various accessions characterized for resistances to biotic stresses, and harvested around 1kg of seed per accession for further multiplication.

Farmers felt strongly encouraged by the fact that many of the local wheat varieties they selected were scientifically proven to perform even better under local conditions than commercial varieties, which should facilitate the re-adoption and further dissemination of disease resistant local varieties.

2.2. DISSEMINATION OF AGRICULTURAL TECHNOLOGIES TO RESPOND TO LOCAL NEEDS

This technology needs cluster focuses on the distribution and/or re-introduction of seeds and propagating material of locally adapted crop varieties that strengthen farmers’ climate change resilience while enabling them to increase or maintain stable yields. This may include both local and improved varieties, as well as CWR. Activities that are directly linked to the distribution of these PGRFA such as, *inter alia*, seed multiplication and the establishment of farmer networks and community level agricultural fairs and seed fairs, are equally considered under this cluster. It also includes on-farm conservation and management of PGRFA, market research for the creation of niche markets for local produce, as well as a series of capacity building and awareness raising activities. These include training in seed production, training in on-farm conservation and management practices, training in processing and value addition, and training in sustainable
intensification and diversification of farming practices; and spreading information on the importance of PGRFA for food security and climate change adaptation among farmers, policy makers and the general public, *inter alia* through information and communication materials. Further, the cluster comprises technology needs related to infrastructure and equipment that strengthen climate change resilience, enhance farm productivity and increase rural incomes, such as community seed banks, nurseries and basic agricultural infrastructure and equipment. Table 2 provides an overview of the proposed technology needs cluster.

Table 2: Technology Needs Cluster 2 – Dissemination of agricultural technologies to respond to local needs

<table>
<thead>
<tr>
<th><strong>training in seed production</strong> (incl. <em>multiplication</em>, establishment of nurseries, on-farm seed production)</th>
<th><strong>multiplication and distribution of seeds and propagating material</strong> (incl. on-farm multiplication, in vitro multiplication, field demonstrations, agricultural fairs and seed fairs, farmer networks and community based seed production)</th>
<th><strong>community seed banks</strong> for storage, participatory evaluation and distribution of PGRFA (incl. household gene banks and farmers’ field gene banks)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>training in on-farm conservation and management practices</strong> (incl. through farmer field schools)</td>
<td><strong>nurseries</strong> operated by farmer breeders (incl. for local and locally adapted varieties, and for on-farm cultivation of CWR)</td>
<td><strong>creating farmers’ groups and networks</strong> for on-farm conservation, seed multiplication and exchanges of PGRFA and knowledge (incl. community board for community seed bank management, farmers’ clubs, women self-help groups, seed cooperatives, seed exchange networks and seed distribution task forces)</td>
</tr>
<tr>
<td><strong>on-farm conservation and management</strong> (incl. re-introduced ex situ material)</td>
<td><strong>training in sustainable intensification and diversification of farming practices</strong> (incl. field demonstrations, agricultural fairs, conservation agriculture, integrated pest management, organic fertilizers, water source management and row planting pattern)</td>
<td><strong>basic agricultural infrastructure and equipment</strong> (incl. irrigation facilities such as wells, home gardens, greenhouses, fences, tools and other materials)</td>
</tr>
<tr>
<td><strong>market research</strong> for the creation of niche markets for local produce (incl. <em>processed and value added products</em>)</td>
<td><strong>training in processing and value addition</strong> (incl. commercial processing, harvesting, threshing, storage of produce, packaging and product marketing)</td>
<td></td>
</tr>
</tbody>
</table>

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16 In addition, needs with regard to raising awareness on the importance of PGRFA for food security and climate change adaptation; linking different stakeholders of the seed chain; developing and strengthening legal and policy frameworks; and stakeholder involvement are relevant to both technology needs clusters and therefore not specifically mentioned in this overview. For more information on these items, please refer to the *annex* to this paper.
Box 2: Seeds for Life – Action with Farmers in Uttar Pradesh – Indian Ganges Plain region – to enhance Food Security in the Context of Climate Change (an example from the Benefit-sharing Fund’s second project cycle)

This project aimed at contributing to the development of sustainable food security for 50 villages located in a rice and wheat producing area that is predicted to be seriously affected by climate change. The project did so by strengthening farmers’ capacities in seed conservation, rice cultivation intensification and improved wheat cultivation, and by diversifying the farming systems through the promotion of further rice and wheat varieties, as well as other crops.

The 50 villages that benefited from the project covered 650 families (or about 4000 people). Of these, about 450 women farmers had organized themselves into self-help groups, and about 150-200 farmers were organized in farmers’ clubs. Most project activities were implemented through the involvement of the members of the farmers’ clubs and the women self-help groups that had been established to that end. The project’s main activities were:

**Establishment of local gene banks**

Local level gene banks with cool and dry chambers were established, to store collected seeds, share them with a national gene bank and distribute them to farmers in following growing seasons. The members of the farmers’ clubs and the women self-help groups were trained in the operation and maintenance of the facilities, so that they would be able to run them independently after the completion of the project. This ensured the farmers’ access to locally adapted planting material in the long run, conferring them control over their own propagating material.

**Farmer training**

The project also promoted further training activities, including training in on-farm conservation techniques. An important element of the project was farmer training in ecological farming practices that increase agricultural yield. To that end, selected model farmers were involved in preparing demonstration plots, where sustainable rice cultivation intensification and improved wheat cultivation techniques are demonstrated.

**Introduction of new crops and income generation**

In order to reduce farmers’ vulnerability to climate change by lessening their dependence on wheat and rice, and to enhance their food security and generate additional income, three new crops were introduced to the participating villages under the project: Amaranth, Moringa and Quinoa. All three crops are high in protein content, relatively drought tolerant, and valuable as additional food to the traditional diet. Most importantly, these crops can be cultivated both alongside the staple crops as well as during the fallow season. Simultaneously, the project was training the women self-help groups and farmers’ clubs in the preparation of the newly introduced crops for cooking and packaging for household level consumption, contract supply or direct sale in the market, and aimed at establishing market linkages.

3. **KEY FINDINGS**

The technologies demanded under the Benefit-sharing Fund are mainly linked to the availability, development and conservation of PGRFA, as well as to a set of related training and awareness raising activities. A particular need was expressed with regard to technologies for the characterization, evaluation and documentation of collected local varieties and other *ex situ* held material, especially for the identification of climate change resistant varieties and traits. Equally, technologies to enhance the distribution of locally adapted varieties to farmers, including through seed multiplication, re-introduction of *ex situ* material, seed fairs and community seed production, figured very high on the demands of applicants.

Further, the following technology needs were expressed by a majority of project proposals, in descending order: raising awareness on the importance of PGRFA for food security
and climate change adaptation among farmers, policy makers and the general public, *inter alia* through information and communication materials; different breeding techniques, in particular PVS and PPB, but also marker-assisted selection and those related to pre-breeding; *ex situ* conservation of collected material; training in PVS and PPB; training in cultivation techniques, in particular sustainable intensification and diversification of farming practices; collecting local varieties and CWR; training in on-farm conservation and management practices; and the establishment of community seed banks and nurseries.

The ultimate beneficiaries of all the requested technologies presented in this document are farmers in developing countries, but also consumers all over the world and gene banks and breeders who will enjoy access to a greater variety of PGRFA for their activities. The primary beneficiaries of requested technologies for the characterization, evaluation and documentation of PGRFA, as well as for the collection and *ex situ* conservation of local varieties and CWR, are mainly breeders and gene banks. On the other hand, farmers constitute the primary beneficiary group of requested technologies to enhance the distribution of locally adapted varieties; PVS and PPB; training in PVS and PPB, cultivation techniques, and on-farm conservation and management; and community seed banks and nurseries.

Any governmental or non-governmental organization, including gene banks and research institutions, farmers and farmers’ organizations, and regional and international organizations, based in developing countries that are Contracting Parties to the International Treaty, may apply for grants under the Benefit-sharing Fund. Consequently, most of the partnerships for co-development and transfer of technology and related work carried out so far were:

- **Within countries:**
  - Public-public partnerships for research: these projects were mostly for research and have been implemented through national gene banks, national agricultural research institutes, national agricultural extensions services, or a combination thereof.
  - Public-non-governmental partnerships: research and delivery, including several projects, were also implemented by universities and civil society organizations.
  - While there were no cases of partnerships with the private sector, a small number of projects involved the establishment of local private small-scale enterprises for seed delivery.

- **Between countries:**
  - In the cases where a project involved institutions from more than one country, transfers of technology and related collaborations were primarily South-South. A number of them included cooperation with CGIAR centers.

Whereas most technology needs were expressed in terms of particular problems that require technology solutions, rather than in terms of specific technologies, some project proposals presented their technology needs in a very concrete manner. More detailed information can be found in the Technology Needs Matrix contained in the annex.

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17 The list of Contracting Parties eligible to apply for support under the Benefit-sharing Fund will be prepared by the Secretary for each round of the project cycle, based on a complete list of developing countries derived from the most recent World Bank’s classification of economies.
### 4. ANNEX: TECHNOLOGY NEEDS MATRIX (BY PRIMARY BENEFICIARY GROUP)

<table>
<thead>
<tr>
<th>Primary beneficiary group</th>
<th>Seeds and propagating material</th>
<th>Knowledge</th>
<th>Organizational structures, strategies, programmes and policies</th>
<th>Infrastructure and equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gene banks</td>
<td>- collecting local varieties and CWR (incl. through field demonstrations, agricultural fairs and seed fairs) - <em>ex situ conservation of collected material</em> (incl. in community seed banks, national and international gene banks, inter alia through <em>in vitro</em> technology and cryopreservation)</td>
<td>- surveying local crop diversity (incl. ecogeographic surveys) - <em>characterization and evaluation</em> of collected material and other ex situ material for high yields and climate change resistance (incl. through GIS techniques, on-station trials, lab tests, farmer evaluation, on-farm evaluation, phenotypic evaluation, molecular characterization, morphological characterization, agronomic characterization)</td>
<td>- modernize national banks (incl. laboratory and equipments for seed health testing and <em>in vitro</em> conservation)</td>
<td></td>
</tr>
<tr>
<td>Breeders and gene banks</td>
<td></td>
<td></td>
<td></td>
<td>- electronic databases as a one-stop access point for evaluation and characterization data on PGRFA (incl. information on traditional knowledge and climate change adaptation strategies)</td>
</tr>
<tr>
<td>Farmers, breeders and gene banks</td>
<td></td>
<td>- raising awareness on the importance of PGRFA for food security and climate change adaptation among</td>
<td>- linking different stakeholders of the seed chain, including farmer breeders, public and</td>
<td></td>
</tr>
</tbody>
</table>


| Farmers and breeders | - breeding locally adapted, high-yielding and climate change resistant varieties: **PVS and PPB** (incl. on-farm selection and observation trials), **marker-assisted selection** and **pre-breeding** | - **documentation of traditional knowledge** (incl. local cultivation practices, local climate change adaptation strategies, farmer criteria for variety selection, seed storage techniques, consumption patterns) | - **market research** for the creation of niche markets for local produce (incl. processed and value added products) | - **creating farmers’ groups and networks** for on-farm conservation, seed | - **community seed banks** for storage, participatory evaluation and distribution of PGRFA (incl.) |

| Farmers | - on-farm conservation and management (incl. re-introduced ex situ material) | - **private sector breeders**, researchers, national gene banks and community seed banks | - developing and strengthening legal and policy frameworks for sustainable use and on-farm conservation and management of PGRFA in relation to food security and climate change adaptation (incl. local benefit-sharing agreements, local and national action plans, policy recommendations, strategic frameworks) | - field demonstrations |
- **multiplication and distribution of seeds and propagating material** (incl. on-farm multiplication, in vitro multiplication, field demonstrations, agricultural fairs and seed fairs, farmer networks and community based seed production)
  - training in PVS and PPB (incl. farmer seed selection, on-farm characterization and evaluation, community evaluation, training for trainers, participatory seed management)
  - training in on-farm conservation and management practices (incl. through farmer field schools)
  - training in seed production (incl. multiplication, establishment of nurseries, on-farm seed production)
  - training in sustainable intensification farming practices (incl. field demonstrations, agricultural fairs, conservation agriculture, integrated pest management, organic fertilizers, water source management and row planting pattern)
  - training in processing and value addition (incl. commercial multiplication and exchanges of PGRFA and knowledge (incl. community board for community seed bank management, farmers’ clubs, women self-help groups, seed cooperatives, seed exchange networks and seed distribution task forces)
  - stakeholder involvement, especially of farmers, in all project activities (incl. multistakeholder processes, on-farm evaluations, farmer field schools, PVS and PPB)
  - household gene banks and farmers’ field gene banks)
  - **nurseries** operated by farmer breeders (incl. for local and locally adapted varieties, and for on-farm cultivation of CWR)
  - **demonstrative units** managed by farmers, for comparative trials, participatory evaluation, multiplication and exchange of PGRFA (incl. pilot sites, model farms and evaluation plots)
  - **basic agricultural infrastructure and equipment** (incl. irrigation facilities such as wells, home gardens, greenhouses, fences, tools and other materials)
| processing, harvesting, threshing, storage of produce, packaging and product marketing |   |   |
1. Introduction

The ITPGRFA refers to ‘transfer of technology’ in article 5.1(c) and in article 13.2(b). In accordance with this latter provision, ‘access to and transfer of technology’ is one of the means of non-monetary benefit sharing to be provided for under the Multilateral System (MLS).

Resolution 4/2011 of the Governing Body of the ITPGRFA recognized that ‘in addition to the sharing of the benefits arising from commercialization of plant genetic resources for food and agriculture, Contracting Parties shall share the benefits arising from the use of plant genetic resources through the mechanisms of …access to and transfer of technology…’. The Governing Body invited ‘Contracting Parties and other relevant stakeholder to explore innovative benefit sharing measures within the purview of Articles 13.2a, b, and c of the Treaty’.

Pursuant to the ITPGRFA’s mandate, the implementation of benefit sharing through access to and transfer of technology has been established as one of the funding priorities adopted by the Governing Body for the use of the resources of the Treaty’s Benefit-sharing Fund.

The Governments of Indonesia and Norway convened a Global Consultation on Benefit-sharing under the Multilateral System, in Bogor, Indonesia, March 2011, which focused on particular ways to realize technology transfer, in support of the Treaty. Subsequently, at the United Nations Conference on Sustainable Development (Rio de Janeiro, Brazil, 21 June 2012), a High-level Round Table convened by the Governments of Brazil, Indonesia and Norway, adopted the Rio Six-point Action Plan for the International Treaty. It recommended, as a priority, that stakeholders in the Treaty “establish a Platform for the Co-Development and Transfer of Technologies, within the context of non-monetary benefit-sharing under the Treaty”.

In continuation of these efforts, the Brazilian Agricultural Research Corporation (EMBRAPA) in conjunction with the Ministry of Agriculture, Livestock and Food Supply and the Ministry of Environment, and the Indonesian Agency for Agricultural Research and Development (IAARD) hosted a workshop with a number of stakeholders to discuss the establishment of a platform for transfer of technology, considering existing experiences. The workshop noted “the difficulty that has in the past been faced in finding an effective approach to technology transfer, and that this is creating uncertainties and tensions around the concept of non-monetary benefit-sharing. It realized that technology is being transferred all the time, in many different ways, through
international and national research institutions, through a variety of international projects, and through the commercial sector.\footnote{Report, Workshop to Discuss a Platform for the Co-Development and Transfer of Technologies, Brasília, 7-8 August 2012 (hereinafter ‘Brasilia Report), available at http://www.planttreaty.org/sites/default/files/brasilia_2012_report.pdf}

The Brasilia workshop also noted ‘that technology should be understood in a very wide sense; that technology transfer should aim to solve problems, not impose specific solutions’. It considered that ‘a Platform, where institutions active in technology transfer, including technical bodies and donor institutions could together work to structure technology transfer packets. The Platform could provide a coordination and initiation mechanism, which could make a substantial contribution to mobilizing resources, including those of the initial proponents themselves, and to focusing technology transfer initiatives.’\footnote{Id.}

This document has been prepared in response to the Brasilia workshop’s request of ‘an assessment of current models of technology transfer’. It examines, first, the content of the ITPGRFA’s provisions relating to transfer of technology as a component of benefit sharing. Second, it considers different aspects of various models of transfer of technology. Third, it presents some examples of initiatives, not limited to the area of PGRFA, which may be useful to be considered in defining future actions for the implementation of benefit sharing under the ITPGRFA. Finally, the document addresses some elements that would be important to take into account in assessing different models of transfer of technology.

2. Transfer of technology as benefit sharing under the ITPGRFA

Article 13.2 contains a number of elements that are important to understand the possible ways of implementing transfer of technology as a mechanism of benefit sharing under the MLS.\footnote{The analysis that follows does not attempt to provide an interpretation of the examined provisions of the ITPGRFA, but to clarify some elements to facilitate discussions on possible actions for the implementation of benefit sharing through transfer of technology under the MLS.}

The concept of ‘transfer of technology’

As noted, the concept of ‘transfer of technology’ is used in the ITPGRFA in two provisions. Clauses for the transfer of technology are included in many other international agreements, such as the Sea Convention (article 144), the UNFCCC (article 4(c)), the Montreal Protocol (article 10A), Basel Convention (article 10.2(d)), Kyoto Protocol (article 4.1 (c)), CBD (article 16), the Energy Charter (article 19.1 (h)), GATS (article IV.1(a)) the TRIPS Agreement (article 66.2), and the Nagoya Protocol (article 23).

However, none of these instruments defines what ‘transfer of technology’ is.\footnote{A definition of ‘transfer of technology’ was agreed upon in the negotiations of the Draft International Code of Conduct on The Transfer of Technology conducted under UNCTAD auspices. The definition was as follows: ‘Transfer of technology … is the transfer of systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a service and does not extend to the transactions involving the mere sale or mere lease of goods’ [1985 version].} In the absence of a definition of particular terms in an international treaty, they should be interpreted in accordance with their ordinary meaning, taking into account their context and the treaty’s object and purpose.\footnote{See article 31.1 of the Vienna Convention on the Law of the Treaties.} This implies that, even in cases where the same terms are used in different international treaties, the specific meaning attributed to such terms in each treaty needs to be determined.
As recognized in article 13.2.b(i), ‘some technologies can only be transferred through genetic material’, including ‘improved varieties and genetic material developed through the use of plant genetic resources for food and agriculture under the Multilateral System’. Hence, in the case of the ITPGRFA, ‘transfer of technology’ may be understood as the process through which samples of FGRFA and knowledge relating to PGRFA is transmitted from a party in one Contracting Party to a party in the same or other Contracting Party.

The ITPGRFA calls for access and technology transfer as benefit sharing (article 13.2.b) backed by information exchange (article 13.2.a) and in relation to capacity-building (article 13.2.c). Therefore, transfer of technology may be seen as complementary to other forms of benefit sharing, particularly to capacity building in the area of conservation and use of PGRFA.

Article 13.2.b(i) clarifies that, for the purpose of this provision, the technologies to be transferred in implementing the benefit sharing obligations under the MLS relate to the conservation, characterization, evaluation and use of PGRFA that are under the Multilateral System. Although no specific reference is made to technologies for the genetic modification of PGRFA, they may be deemed included in those relating to the use of such resources.

**Conditions relating to access**

Article 13.2(b)(i) also clarifies that access to technologies, improved varieties and genetic materials shall be provided and/or facilitated ‘while respecting applicable property rights’. These rights may encompass rights on tangible materials (e.g. on samples of a particular PGRFA) and intellectual property rights, such as patents, trade secrets or breeders’ rights. As a result, Contracting Parties would not be required to transfer technologies or materials the access to which is subject to the authorization of one or more right holders.

In addition, in providing access in accordance with Article 13.2(b)(i), ‘access laws’ need to be respected. This would apply, in particular, to PGRFA in *in situ* conditions, which ‘will be provided according to national legislation or, in the absence of such legislation, in accordance with such standards as may be set by the Governing Body’ (article 12.3(h)).

Finally, access to technology, including genetic materials and improved varieties should be granted ‘in accordance with national capabilities’. This qualification means that the stated obligation to provide access and transfer would be subject to the limitations arising out from the potential transferor’s infrastructure and availability of resources (e.g. insufficient samples in a gene bank).

**Mechanisms for the transfer of technology**

Article 13.2(b)(ii) describes, in a non-exhaustive manner, the possible modalities of transfer of technology as part of benefit sharing under the MLS of the ITPGRFA. They include:

a) the establishment and maintenance of, and participation in, ‘crop-based thematic groups’ on utilization of PGRFA;

b) partnerships in research and development;

c) commercial joint ventures.

d) access to research facilities.

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23 Such material would not include material being developed by farmers, access to which is subject to ‘the discretion of its developer, during the period of its development’ (article 12.3(e)).

24 Accordingly, the mere sale or donation of seeds would not constitute a form of ‘transfer of technology’.

25 Article 12 (b) (iii) reiterates that ‘access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights’.
This enumeration suggests, on the one hand, that both commercial and non-commercial modalities of technology transfer are considered and, on the other, that the development of the recipient’s capacity is, as mentioned above, an intended objective of benefit sharing through technology transfer.

Who are the transferors and transferees?

In accordance with article 12 (b) (i) access to the required technologies, improved varieties and genetic material ‘shall be provided and/or facilitated’.

While the ITPGRFA obligations relating to transfer of technology apply to the Contracting Parties, a large part of technologies, seeds and other assets are under the control of private parties. In this case, Contracting Parties will discharge their obligation by facilitating access, for instance, by providing technical assistance or financial support for the transfers to take place.

Potential transferees, in the context of the ITPGRFA, are likely to mainly be farming communities, as well as national agricultural research institutions in developing countries and LDCs. Local seed companies in these countries may also benefit from such transfers.

3. Models of technology transfer

There are various approaches to consider possible ‘models’ of technology transfer. An abundant literature has been developed around qualitative and quantitative models to facilitate the effective planning and implementation of technology transfer projects.\(^\text{26}\)

Given the already mentioned relationship between technology transfer and capacity building under the ITPGRFA, transfer of technology as benefit sharing under the MLS may be viewed as a process of movement of technology from one party to another that allows for the absorption\(^\text{27}\) of the technology, its adaptation\(^\text{28}\) to the particular context and needs of the recipient, as well as its further improvement\(^\text{29}\). These processes are generally possible if the mechanisms of transfer of technology are such that an effective learning\(^\text{30}\) by the recipient can take place. The elements discussed below are relevant to the implementation of different models of transfer of technology.

Accessibility

Transfer of technology is associated in the ITPGRFA to the concept of ‘access’ (see the title and the text of article 13.2(b)). This suggests that a key objective of the ITPGRFA is to ensure, as part of the non-monetary benefit sharing, that technologies relating to PGRFA are accessible. Different situations may be identified in relation to accessibility, such as:

a) the relevant technologies are in the public domain and information thereon can be accessed (e.g. through data bases) and utilized by potential recipients through technical assistance or training;

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\(^{27}\) Absorption’ means the process that allows the effective use of the received technology in the recipient’s productive activities.

\(^{28}\) ‘Adaptation’ means the modification of the received technology to suit local conditions; it often requires investment and organizational changes by the recipient.

\(^{29}\) ‘Improvement’ means the introduction of incremental changes to the received technology.

\(^{30}\) See below.
b) the relevant technologies are subject to intellectual property rights that restrict the third parties’ use of the protected subject matter in the recipient country: individual negotiations with the right holder to obtain authorization for use, normally against payment of a remuneration would be required;

c) the same situation as in b) but any interested party may use the protected subject matter under pre-determined conditions, without the need of prior negotiation with the right holder.31

d) technologies subject to intellectual property rights may be accessed without the consent of the right holder on the basis of non-voluntary licenses or other exceptions provided for by the national law in accordance with international treaties32.

Commercial & non-commercial

Transfer of technology often takes place on a commercial basis. Technology is traded against payment of a remuneration, including lump-sums and different modalities of royalties (percentage of net sales price, per unit sold, fixed or variable, etc.). The ITPGRFA does not seem to exclude transfer of technology as benefit sharing on a commercial basis, in cases where the relevant technologies are not under the control of the Contracting Parties. In these cases, Contracting Parties should ‘facilitate’ the transfer of such technologies (article 13.2(b)(i) of the ITPGRFA).

Multiple negotiations

Access to needed technologies may be difficult when multiple right holders claim intellectual property rights over different aspects or components needed to put a given technology into practice. This is the case, for instance, where various genetic parts and components (including, where allowed by the national law, native traits), genetic constructs (e.g. gene promoters, transit peptides), or microorganisms33 have been patented by different companies, or where such constructs are incorporated into plant varieties owned by another party.

Given the territoriality of patents, the need to get a license only arises out in countries where they have been protected and the protection is still in force. In these situations, if several right holders assert rights over the required technology, the potential technology recipients would be bound to engage in multiple negotiations to avoid infringement and possible litigation.

The absence of protection in the country where the invention is used would not, however, avoid potential obstacles in countries to which products that incorporate the invention are exported.34

The setting up of a patent pool35 may facilitate access to technologies held by multiple parties (see some examples below).

Readiness to use

Certain technologies can be used, as transferred, without further experimentation, when they have already been tested or used in production, and when all the elements necessary for their application are made available to the transferee. The transfer of ready-to-use technology may have significant advantages to the transferor, since there may be no significant costs to implement the

31 This is the case, for instance, where a patent pool was created or the right holder offers licenses under pre-determined conditions (see examples below).

32 See, e.g. article 31 of the TRIPS Agreement; article 9 of UPOV 1978; article 17 of UPOV 1991.


34 In Monsanto v. The European Court of Justice ruled that the importation of soya flour made from transgenic material patented in Europe by Monsanto did not amount to patent infringement. The decision would have arguably been different if exports of seeds would have taken place.

35 A ‘patent pool’ allows a party to use, under pre-determined conditions, a group of patents on a particular technology belonging to two or more right-holders.
transfer, as well as for the transferee, as the technology may be put to use without delay. These advantages may be offset by problems relating to the adaptability of the technology to the conditions where it will be applied (see below). In addition, the transfer of ready-to-use technology may limit the long term effects of the transfer in terms of enhancing the recipient’s capacity to improve on and develop its own technologies.

**Vertical and horizontal transfer**

The process of transfer of knowledge from basic to applied research, to experimental development\(^{36}\) and then to production has been characterized as ‘vertical transfer of technology’, as opposed to situations where technology already in use in one place, organization or context is transferred to another place, organization or context (‘horizontal transfer’).\(^{37}\)

Vertical transfers of technology generally require investment and scientific/technical capabilities on the recipient side that are not generally needed in the case of horizontal transfers. In the former case, the recipient may need to conduct research or experimentation in order to be able to make an effective use the technology. Moreover, the risks involved in vertical transfers are greater, since a viable product or technology may not be finally obtained.

Situations like this arise out, for instance, when a research institution transfers technology developed within its laboratories which has not been put in practice yet. The same would occur in cases where, for instance, a license is offered on a patented genetic component to be incorporated into the licensee’s plant varieties, or where samples of a plant variety are supplied to be crossed with the recipient’s own materials.

**Technology packets**

Transfer of technology in the framework of the ITPGRFA may take place with regard to isolated items (e.g. seeds, cultivation methods, breeding methods). Depending, however, on the capability of the recipient party, the individual transfer of such items may not lead to an effective absorption of the transferred technology allowing for its direct application into production. Thus, the transfer of samples of PGRFA may be of little immediate utility if necessary passport data and other associated information is not transmitted,\(^{38}\) or where training is not provided to adequately manage cultivation, harvesting or storage. Hence, as noted in the Brasilia Report, an effective model of transfer of technology may require the creation of “technology transfer packets…with the objective of providing “one-stop shop” solutions to the expressed needs of the target communities and end users’.\(^{39}\)

Technology transfer packets may involve different components as illustrated in table 1.

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\(^{36}\) Experimental development is ‘systematic work, drawing on existing knowledge gained from research and/or practical experience, that is directed to producing new materials, products or devices; to installing new processes, systems and services; or to improving substantially those already produced or installed’, OECD Frascati Manual, Sixth edition, 2002, para. 64, page 30.

\(^{37}\) These modalities have also been called ‘internal’ and ‘external’ technology transfer, respectively. See Ramanathan, op. cit. p. 5.

\(^{38}\) The Standard Material Transfer Agreement (SMTA) developed in accordance with the ITPGRFA requires the communication of ‘passport data and, subject to applicable law, any other associated available non-confidential descriptive information ‘(article 5(b)).

\(^{39}\) Brasilia Report, p. 2.
Table

Components of technology packets

<table>
<thead>
<tr>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical assistance</td>
</tr>
<tr>
<td>Training</td>
</tr>
<tr>
<td>Supply of information, including know-how, on</td>
</tr>
<tr>
<td>technologies and equipment, methods of</td>
</tr>
<tr>
<td>cultivation, harvesting and storage, breeding</td>
</tr>
<tr>
<td>methods, methods for genetic transformation,</td>
</tr>
<tr>
<td>etc.</td>
</tr>
<tr>
<td>Supply of samples of PGRFA</td>
</tr>
<tr>
<td>Supply of equipment</td>
</tr>
<tr>
<td>Licenses of intellectual property rights</td>
</tr>
</tbody>
</table>

Technology packets may, hence, differ with regard to the ‘intensity’ of different components. They may be classified as:

- *Material intensive*: the transfer of equipment, seeds, etc. is the core element of the transaction.
- *Information intensive*: intangible knowledge is the main element of the transaction.
- *Research and development intensive*: the transfer of technology cannot be implemented without additional R&D, such as when a technology is licensed by an university or a collaborative project is set up in order to develop and put a technology into operation.

4. Initiatives for transfer of technology

This section briefly describes some examples of initiatives taken by different institutions and companies to operationalize or facilitate the transfer of technology for production or research. In presenting this sample, there is no intention to be exhaustive in terms of coverage nor to suggest an opinion on the relevance or impact of each initiative. The examples include schemes applicable to technologies relating to PGRFA and other fields\(^{40}\).

*Preferential licensing*

A number of schemes have been developed by institutions or companies to facilitate access to technologies, *under preferential terms and conditions*, by potential recipients in developing or least developed countries (LDCs). One example is the ‘humanitarian license reservation’ (or

\(^{40}\) The information presented below was obtained and is reproduced from official websites of the respective companies or institutions. No analysis about the impact of various initiatives has been conducted.
equitable access license) proposed by a number of institutions and universities\(^{41}\), whereby title-holders leave open the possibility of sharing their technology with third parties for the benefit of people in need.

Another example is the case of licenses made available with regard to a genetically engineered rice rich in Vitamin A (known as ‘golden rice’), for which licenses for ‘humanitarian uses’ were offered in accordance with the terms and conditions summarized in Box 1.

**Box**

**Golden rice sub-licensing agreements\(^{42}\)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>The inventors(^{41}) assigned their exclusive rights to the <em>Golden Rice</em> technology to Syngenta.</td>
</tr>
<tr>
<td>2.</td>
<td>Syngenta added some further technologies, and arranged licences with other companies for some additional technologies to be included in the original <em>Golden Rice</em>.</td>
</tr>
<tr>
<td>3.</td>
<td>Syngenta, in turn, has given the inventors a humanitarian licence with the right to sublicense public research institutions and low-income farmers in developing countries, to the full set of necessary technologies.</td>
</tr>
<tr>
<td>4.</td>
<td>Syngenta retains commercial rights, although it has no plans to commercialize <em>Golden Rice</em>.</td>
</tr>
</tbody>
</table>
| 5. | ‘Humanitarian Use’ means (and includes research leading to):
| | Use in developing countries (low-income, food-deficit countries as defined by FAO)
| | Resource-poor farmer use (earning less than US$10,000 per year from farming)
| | The technology must be introduced into public germplasm (seed) only (see below).
| | No surcharge may be charged for the technology (i.e. the seed may cost only as much as a seed without the trait)
| | National sales are allowed by such farmers (in this way urban needs can also be covered)
| | Reusing the harvested seed in the following planting season is allowed (the farmer is the owner of his seeds)
| 6. | Regulatory imperative and national sovereignty, i.e. *Golden Rice* may not be released in a country lacking biosafety regulations, and the decision to adopt the technology is a national matter. |
| 7. | No export allowed (except for research to other licensees); this is a humanitarian project, i.e. the seeds are meant to cover the daily requirements of the poor populations that are deficient in vitamin A. |
| 8. | Improvements to licensed technology:
| | Commercial rights of improvements to the technology go to Syngenta, but Humanitarian Use of such improvements is guaranteed under the same terms of the original agreement |
| 9. | No warranties are given by licensor/s. |


\(^{42}\) See http://www.goldenrice.org/Content1-Who/who4_IP.php.

\(^{43}\) Prof emeritus Ingo Potrykus, of ETH-Zurich and Prof Peter Beyer, of the Univ of Freiburg.
**Licensing under pre-determined conditions**

Negotiations to obtain a license to use intellectual property rights may be complex, time consuming and require costly specialized advice. This may discourage potential users of a technology to undertake research or production. Access to protected technologies may be facilitated by the establishment of predetermined terms and conditions under which any interested party that meet certain conditions can obtain a license.

One example in the field of PGRFA is the Syngenta’s ‘E-licensing’ system under which plant breeders, companies and public research institutes may obtain access, without the need of individual negotiations, to some innovations related to patented native traits present in commercial vegetables varieties, in accordance with ‘fair, reasonable and non-discriminatory’ (FRAND) conditions.

Some elements of the E-license system include:

- Access to licenses via the internet without lengthy and complex negotiations
- Transparency of FRAND licensing conditions, applicable to all plant breeders or other parties interested in a license
- A free research license for academic or non-for-profit parties
- A standard license agreement for other entities, with commercial terms adapted for small, medium and large entity sizes
- Accessibility to a portfolio of patented native traits present in Syngenta’s commercial vegetables varieties, including:
  - "Free access" for licensed native traits during development and breeding of new varieties
  - Royalty payment only due if the newly-developed and commercialized variety contains the patented native trait.

**Patent pools**

Patent pools, as noted above, make available under predetermined conditions, licenses of patents owned by two or more right-holders in relation to certain technologies. Some examples from different fields are provided below.

Upon an initiative from GlaxoSmithKline (GSK), a healthcare company, a ‘Pool for Open Innovation’ was set up to encourage pharmaceutical and biotechnology companies, universities and non-governmental organizations to pool patents on small molecule compounds and related processes for neglected tropical diseases. The initiative is administered by Bio Ventures for Global Health. The objective of this initiative was to accelerate the development and production of new products and formulations for use in the developing world. GSK included 800 granted or pending patent applications into this pool. Other contributors included those from Alnylam Pharmaceuticals, the Emory Institute for Drug Discovery, iThemba Pharmaceuticals, the Massachusetts Institute of Technology and the Technology Innovation Agency of South Africa.

Another example –also in the field of health care- is the Medicines Patent Pool (MPP), which aims to bring down the prices of HIV medicines and facilitate development of better-adapted HIV medicines, such as simplified “fixed-dose combinations” and special formulations for children. The mission of the MPP is to create a pool of relevant patents for licensing to generic

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45 Id.
46 See http://healthresearchpolicy.org/content/pool-open-innovation-against-neglected-tropical-diseases.
manufacturers and product development partnerships, in order to increase access to quality, safe, effective, appropriate and affordable treatment for HIV in low- and middle-income countries. The MPP negotiates public health-driven voluntary licence agreements for patents on HIV medicines, in order to enable generic competition (which lowers prices) and facilitate new product development\(^47\). The MPP has entered so far into agreements with the National Institute of Health, Gilead Sciences and Viiv Healthcare (GlaxoSmithKline, Pfizer, Shionogi). Sub-licenses may be obtained by eligible producers of pharmaceuticas by signing agreements under predetermined terms and conditions.

WIPO’s Re:Search is a consortium through which public and private sector organizations can make available intellectual property available, including:

- compounds
- compound libraries
- unpublished scientific results
- regulatory data and dossiers
- screening technologies
- platform technologies
- expertise and know-how, and
- patents and patent rights

to researchers seeking to develop new solutions for neglected tropical diseases (NTDs), malaria and tuberculosis. Services, such as access to company research facilities, are also offered. Licenses will be royalty-free for product distribution in Least Developed Countries only. The WIPO Re:Search website, www.wipoReSearch.org is freely accessible to the public. Researchers with a potential interest in a particular compound, technology, or service can contact the Partnership Hub Administrator, BVGH, directly on the website\(^48\).

Eco-Patent Commons is a patent pool launched by IBM, Nokia, Pitney Bowes and Sony in partnership with the World Business Council for Sustainable Development (WBCSD). The pooled patents can be freely accessed by any interested party, provided the use by that party achieves environmentally beneficial results. The patents included in the Commons are subject to a covenant, or pledge, by the patent owner not to assert the patent against an environmentally beneficial use of the invention. When another party attempts to enforce a patent against a member of the Commons, the member can terminate its non-assert pledge (defensive termination). Since the launch of the Eco-Patent Commons in January 2008, one hundred eco-friendly patents have been pledged by thirteen companies representing a variety of industries worldwide: Bosch, Dow, DuPont, Fuji-Xerox, Hitachi, HP, IBM, Nokia, Pitney Bowes, Ricoh, Sony, Taisei and Xerox\(^49\).

**Technology brokerage**

Other initiatives aim at promoting the transfer of technology through mechanisms that facilitate contacts between prospective transferors and transferees so as to encourage the conclusion of the pertinent contractual arrangements.

Thus, WIPO GREEN is designed to improve knowledge of and access to existing environmentally sound technologies (ESTs). It intends to achieve this by matching the available technologies, know-how and expertise of “technology providers” with the expressed needs of “technology seekers”. It is a platform that makes it easier for would-be partners to connect with each other. While the mechanism is designed to facilitate the exchange and diffusion of ESTs, its

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\(^{47}\) See [http://www.medicinespatentpool.org/who-we-are2/mission/](http://www.medicinespatentpool.org/who-we-are2/mission/).


role does not extend to establishing specific agreements for technology transfer. Any transactions that take place will be the subject of individually negotiated agreements between the parties concerned.  

The South-South Global Assets and Technology Exchange (SS-GATE) was launched in 2006 (operations started in November 2008) by the United Nations Office for South-South Cooperation (UNOSSC) hosted in the United Nations Development Programme. The current platform is co-sponsored by the China International Center for Economic and Technical Exchanges (CICETE) and the OPEC Fund and it is based in Shanghai, China, and operated in partnership with the Shanghai United Asset and Equity Exchange (SUAEE). It is a virtual and physical platform where entrepreneurs in developing countries can interact and obtain needed technology and assets. It operates through a global network of participating organizations and institutional members. Participation in SS-GATE is regulated through institutional membership.  

5. Assessing transfer of technology models

Section I has examined various features of transfer of technology as a component of benefit sharing under the ITPGRFA, in terms of object, purpose, conditions and beneficiaries. As indicated, such a transfer seems to be intimately related to capacity building. This requires that such transfer leads to an effective learning and absorption of the technology at stake. The following criteria may be used to assess the extent to which different mechanisms of technology transfer may constitute appropriate modalities of benefit sharing under the ITPGRFA.

Appropriateness

A vast literature has addressed the issue of ‘appropriateness’ of a technology to the particular circumstances of the recipient party and country. These circumstances include technical and economic aspects, but also social and cultural dimensions. The latter are often crucial for an effective transfer of technology. The evaluation a priori of the appropriateness of the technology to be transferred is not always simple neither for the transferor, who does not necessarily know the circumstances surrounding the new uses of the technology, nor for the transferee, whose information on the technology is generally imperfect before the transfer actually takes place.

Two dimensions of the transferred technology are particularly relevant to determine its appropriateness:

Compatibility

An important dimension of the technology to be transferred is its compatibility with other technologies in use in the recipient country and the context where they will be applied. This aspect may be assessed, for instance, in terms of the technology’s complementarity to those in use and of possible disruptive effects on the local ecosystems.

In considering the compatibility of a technology, however, not only the technical aspects, such as knowledge, skills, techniques need to be taken into account; both organizational and cultural issues related to technology are, as mentioned, key to the process of technology transfer. Many

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51 Some projects relating to agriculture have been developed in Zambia, relating e.g. to pineapple, cotton and cotton. See http://ssc.undp.org/uploads/media/GATESBro09.pdf.
programs of technical assistance have been based on the wrong assumption that differences in natural and cultural environments are irrelevant for transfer of technology processes. However, the characteristics of the context where the transferred technology is to be applied play a critical role in determining when a technology is appropriate.

**Adaptability**

The concept of ‘appropriate’ technology may be understood not only as alluding to technology that is suitable, as received, to the particular needs of the transferee, but also adaptable to the transferee’s needs. Productivity gains are often obtained through the adaptation of the technology to local conditions. Improvements are also usually made in the process of adaptation.

Contractual terms and conditions in licensing agreements may limit the ability of the transferee to adapt the technology. Moreover, in some cases, the transferee is obliged (under ‘grant-back provisions’) to transfer the improvements it had made to the transferor without any compensation. This type of contractual conditions, which may limit or discourage adaptation and improvement, is generally scrutinized by competition authorities to determine their possible anti-competitive effects.

**Learning through cooperation**

Transfer of technology, as mentioned above, can be regarded as the movement of technology from one party to another. However, the benefits of such transfer may be limited if the process does not involve actual learning of the technology to allow for its effective application, adaptation and improvement. Capacity building is key for the learning processes: knowledge cannot be simply transmitted but should be ‘subjectively constructed by its recipients’. There are various means that can be used to this end, notably the communication of information relevant to understand the technology being transferred and training of the transferee’s personnel. Hence, a well-planned and structured collaboration between transferor and transferee is of outstanding importance to ensure that the transfer is effective. The willingness and capacity of the transferor to cooperate with the transferee is a key element in assessing technology transfer activities.

**Affordability**

As noted, transfer of technology under article 13.2(b) of the ITPGRFA may take place with or without payment of a remuneration to the transferor. Article 13.2(b)(iii) stipulates that protected technologies shall be made available, as a component of benefit sharing, ‘on concessional and preferential terms’. Hence, the conditions under which such transfer takes place should include remuneration, if any, and other conditions that are more favorable than those ordinarily present in commercial transactions. In the case of technology transfers to ‘developing countries that are Contracting Parties, in particular least developed countries, and countries with economies in transition’ technology ‘shall be provided and/or facilitated under fair and most favorable terms, in particular in the case of technologies for use in conservation as well as technologies for the benefit of farmers in developing countries, especially in least developed countries, and countries with economies in transition’ (article 13.2(b)(iii)). The determination on when these special conditions have been met would depend on a case-by-case evaluation.

### 6. Conclusions

An effective process of transfer of technology may be deemed to take place when the conditions of the transfer are such that the recipient is able to learn the technology to make an efficient use of it, as received or as adapted and improved.

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54 See, e.g., Hee Jun Choi (2009), ‘Technology Transfer Issues and a New Technology Transfer Model’, *JOTS*, Volume 35, Number 1, Fall.

55 Id.
The transfer of technology under the MLS of the ITPGRFA may involve technologies at different levels of development, on a commercial or non-commercial basis, and include one or more material and intangible components. Various models can be used to facilitate the transfer of technology, particularly to farming communities in developing countries and LDCs. A key consideration to plan and assess such transfer is the extent to which the transferred technology is appropriate and adaptable to the local conditions, and implemented in a way that allows an effective learning and the improvement of the recipient’s technological capacity.
Annex 6

The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

SECOND MEETING OF THE PLATFORM FOR THE CO-DEVELOPMENT AND TRANSFER OF TECHNOLOGIES

Bandung, West Java, Indonesia, 30 June-1 July 2013

ADDRESSING GLOBAL CHALLENGES THROUGH AGRICULTURAL TECHNOLOGY TRANSFER – A LIST OF SELECTED LITERATURE

Prepared by Patrick Mink and Isabel López Noriega

Introduction

The present document was prepared to inform the discussions of the action partners of the Platform for the Co-development and Transfer of Technologies at their second meeting. It contains a list of bibliographic references, particularly from grey literature, related to technology transfer in the area of agriculture and plant genetic resources for food and agriculture (PGRFA), with a special focus on technology needs assessments (TNA) and agricultural technologies for climate change adaptation. The majority of the literature references are from United Nations agencies and other like-minded international organizations.

However, the document does not pretend to be an exhaustive list. Rather, it aims at providing reference materials for definitions of key concepts and guidelines for technology transfer, as well as for TNA methodologies and actual TNAs that have been carried out for the agricultural sector. The literature references are arranged in thematic sections, with selected examples for each section.

Whereas the sections on concepts and guidelines contain literature about technology transfer more in general, the sections on TNAs, agricultural technologies, enabling and hindering factors for technology transfer, and case studies focus primarily on agricultural technologies and climate change adaptation, including PGRFA and PGRFA-related technologies.

1. Conceptualization of technology transfer

The processes involved in the transfer of technology have been profusely studied and documented. The literature offers many definitions of the term “technology transfer”, and analyzes different types of technology transfer depending on the actors, processes and technologies involved. Since its establishment in 1964, the United Nations Conference on Trade and Development has focused part of its research work on the linkages between trade, investment, technology transfer and development, generating a number of reference documents on the historical background of international technology transfer and on the elements that define it.
This section includes some selected works that provide a conceptual framework for the understanding of technology transfer. It also lists some documents that present the approaches to technology transfer adopted under some multilateral environmental agreements.


2. Technology needs assessments

This section brings together a selection of literature related to TNAs from international organizations. Whereas the first sub-section contains literature on methodological issues when carrying out TNAs, the second sub-section comprises examples of actual TNAs. Several of the literature references listed under both sections do not focus exclusively on agricultural technologies and technologies related to PGRFA, however they all include at least a chapter or section devoted to agricultural technologies or PGRFA or both. In addition, most of the documents deal with TNAs in the context of climate change adaptation.

2.1 Methodologies for technology needs assessment

2.2 Assessments conducted


3. Agricultural technologies

The literature on agricultural technologies is plentiful. This section brings together selected examples extracted from literature of international and other like-minded organizations. These literature references refer to a wide range of agricultural technologies, including PGRFA and PGRFA-related technologies ranging from modern biotechnology to traditional practices for crop diversity management; as well as other agricultural technologies of relevance for climate change adaptation, rural poverty reduction and enhancing food security.


4. Technology transfer guidelines

Some of the documents listed under other sections of this document, particularly under sections 2 Conceptualization of technology transfer and 6 Enabling and hindering factors to technology transfer, address methodological aspects and could therefore be taken into consideration when considering methods and practical approaches to technology transfer. This section is dedicated to selected manuals or guidelines in the “classic” sense.


5. Enabling and hindering factors to technology transfer

The literature on the factors that influence the transfer of technology is very diverse, ranging from studies that look at macro-economic conditions and international policies that facilitate or hinder the movement of funds, goods and people to studies that focus on the suitability of the technologies and the technological capacities of technology providers and recipients. A large body of the literature is dedicated to the role of intellectual property rights in the transfer and adoption of technologies. The examples listed below do not necessarily focus on the transfer of agricultural or PGRFA-related technologies.


6. Case studies of technology transfer

There is an abundance of literature on national case studies explaining transfer of technologies from research organizations to end users within specific countries. In particular, the CGIAR Consortium has very extensive experience in technology transfer related to PGRFA, and has developed hundreds of case studies on adoption and impact of technologies, including in collaboration with national partners. These are available at: http://impact.cgiar.org/

In addition to these case studies of technology transfer from CGIAR research stations to end users in particular countries and regions, this section provides a few selected examples of case studies of international technology transfer that include lessons learned.


