BRIDGING THE KNOWLEDGE DIVIDE:
Experiences in Communicating Crop Biotechnology

Mariechel J. Navarro
with Contributions from
the Biotechnology Information Centers

International Service for the Acquisition of Agri-biotech Applications (ISAAA)

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Preface

The germ of the idea that led to this handbook was conceived a few years ago. There was a felt need for a publication that existing and potential Biotechnology Information Centers (BICs) could use as a guide in doing their science communication work. In addition, an external reviewer of the Global Knowledge Center on Crop Biotechnology (KC) of the International Service for the Acquisition of Agri-biotech Applications (ISAAA) highlighted the fact that the KC had a rich pool of information on and experiences in communicating biotechnology. It was but logical, the expert said, that the KC contribute towards a 'robust knowledge' on science communication using its accumulated experiences. Hence, this publication is meant as a resource for all science communicators.

The excitement over the project, however, was dampened by other concerns and deadlines. It was only in early 2008, after sporadic starts, that this publication eventually got into 'fast forward mode'. By that time, the timing was apt as there were enough materials to use, experiences to document, and lessons learned and ripe for sharing. Contributions solicited from the BICs and perspectives distilled from other science communication experts provided both theoretical and practical inputs.

This handbook starts with a discussion of the importance of communication in biotechnology and how it is a crucial factor in promoting an open and transparent debate on the topic. The development of biotechnology in the global arena and the role of communication in furthering the gains of the technology are emphasized. Communication, however, is looked at not merely from the act of disseminating information but as a process that extends to the acts of engagement and partnering.

An overview of the KC and the BIC network is presented noting its primary stakeholders, organizational set-up, institutional arrangement, funding sources and activities. The handbook then segues to communication specifics: understanding stakeholders, designing a communication plan, identifying key messages, developing strategies and approaches, evaluating efforts, and assessing impact. It ends with a synthesis of lessons learned, capitalizing on issues and concerns for any science communicator.

Aside from the KC and the BIC network, many other institutions are involved in sharing information resources on biotechnology. This handbook, thus, provides an annex of some of these institutions with contact links.

We hope that this handbook can contribute to the exciting field of science communication in general, and biotechnology communication in particular. As a working and evolving document, updates of this publication will be posted at http://www.isaaa.org.

M.J. Navarro

Introduction

Crop biotechnology, one of the many possible scientific options to improve agricultural productivity, has delivered significant socio-economic and welfare benefits to farmers. It is the use of advanced scientific approaches to produce crops that may have any or a combination of the following traits: increased yield, pest and disease resistance, abiotic stress tolerance, enriched nutrient content, and other quality traits.

James (2007) reports that about 12 million farmers in 23 countries have planted biotech crops spread across 114.3 million hectares. Of these farmers, 90 percent or 11 million are small and resource-poor farmers from developing countries such as China, India, the Philippines, and South Africa. At the same time, a few stakeholders have sparked debate on perceived risks and safety of biotech crops. As a result, biotech crops have been caught in a maelstrom of controversy. Diverse issues like scientific, political, economic, ethical, cultural, and even religious viewpoints are raised by different stakeholders. A focus on societal and ethical implications has made it a recurring and contentious public policy issue.

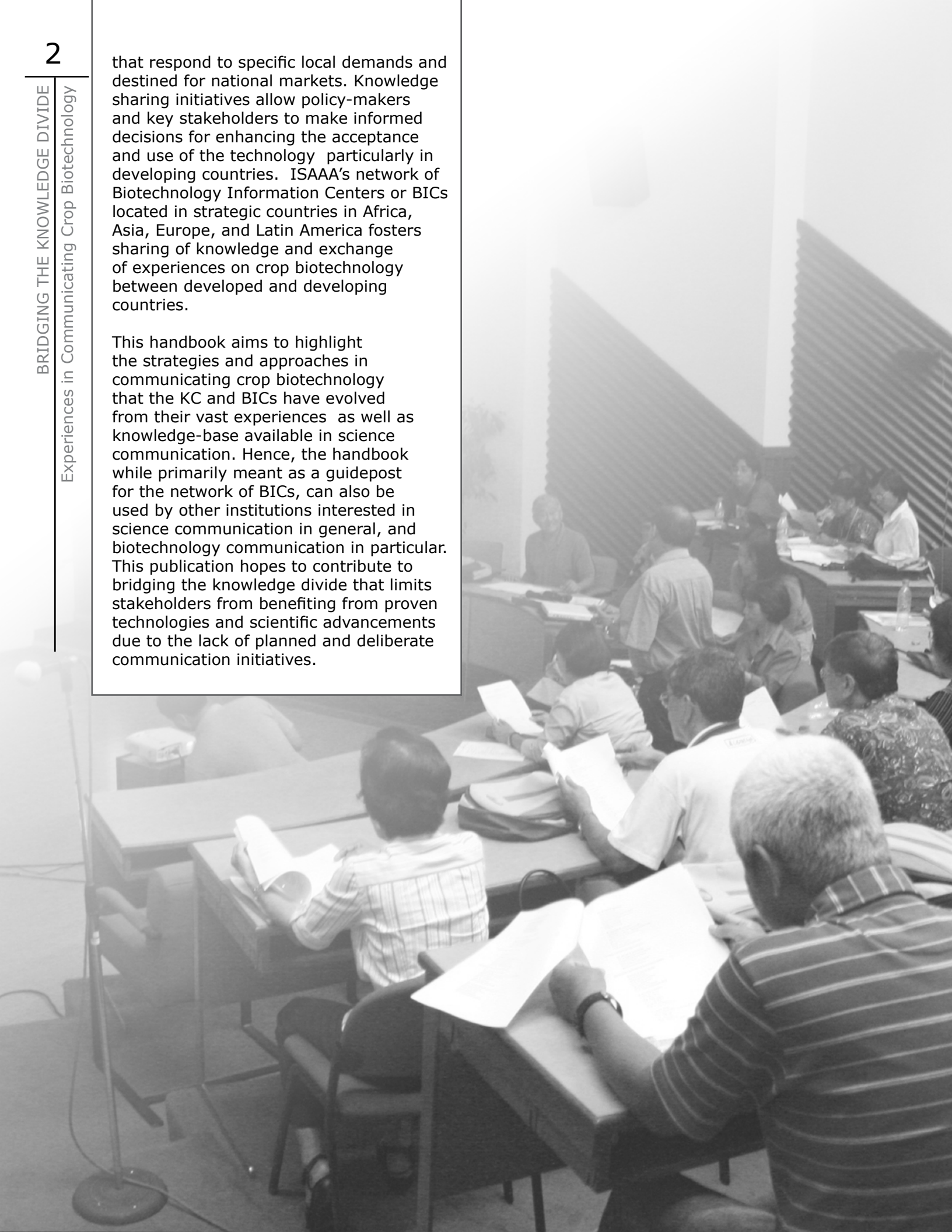
Concerns related to crop biotechnology must be balanced with adequate science-based, authoritative information to enable various stakeholders to engage in an objective and transparent debate. Mutual understanding and dialogue will enable the global community to understand the attributes of crop biotechnology and help farmers and consumers to realize its potential benefits.

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) supports a two-pronged objective – technology transfer and knowledge sharing. It facilitates the transfer of technologies to developing countries through public-private partnerships. ISAAA's flagship program, the Global Knowledge Center on Crop Biotechnology, more familiarly known as the KC, addresses the second objective of making available science-based, authoritative information on crop biotechnology to the global community.

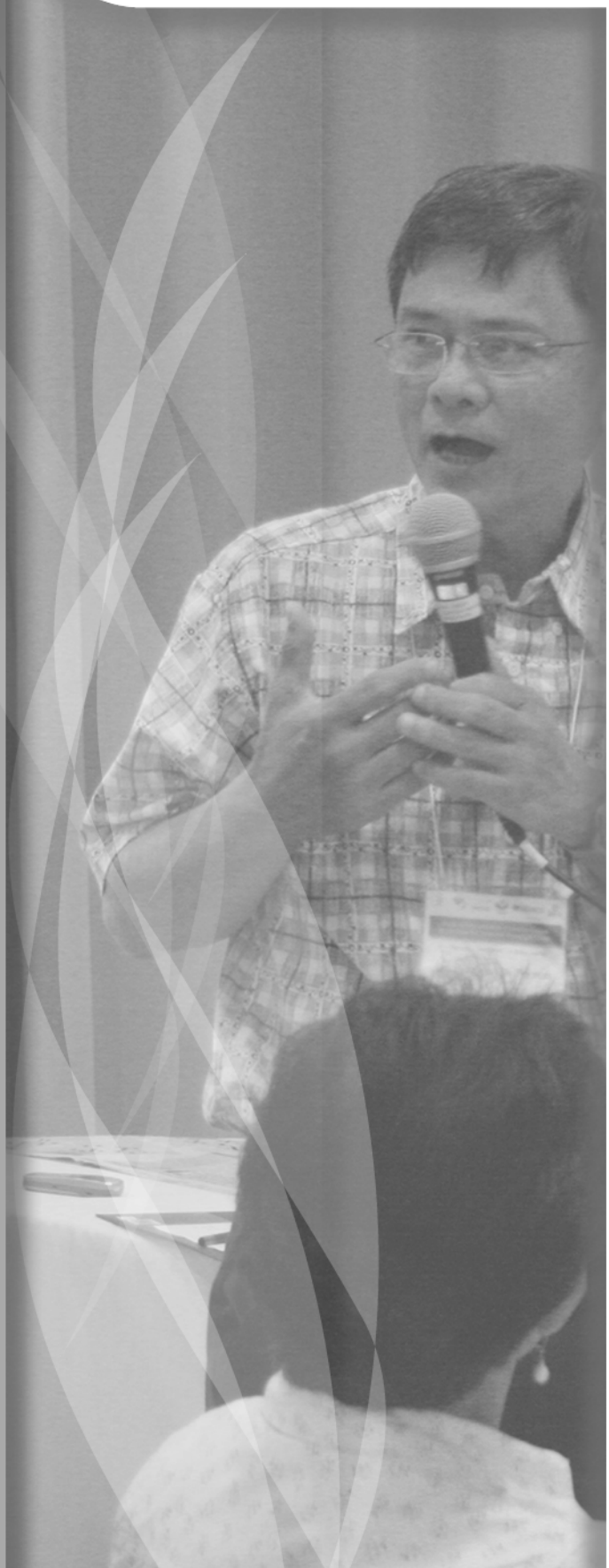
The lack of effective communication may jeopardize projects in the public sector

that respond to specific local demands and destined for national markets. Knowledge sharing initiatives allow policy-makers and key stakeholders to make informed decisions for enhancing the acceptance and use of the technology particularly in developing countries. ISAAA's network of Biotechnology Information Centers or BICs located in strategic countries in Africa, Asia, Europe, and Latin America fosters sharing of knowledge and exchange of experiences on crop biotechnology between developed and developing countries.

This handbook aims to highlight the strategies and approaches in communicating crop biotechnology that the KC and BICs have evolved from their vast experiences as well as knowledge-base available in science communication. Hence, the handbook while primarily meant as a guidepost for the network of BICs, can also be used by other institutions interested in science communication in general, and biotechnology communication in particular. This publication hopes to contribute to bridging the knowledge divide that limits stakeholders from benefiting from proven technologies and scientific advancements due to the lack of planned and deliberate communication initiatives.



II Communication and Biotechnology



Public support is crucial if a technology is to be accepted and adopted by those who stand to benefit from it. Hence, science communication is an important component of the technology generation and utilization continuum. Science communication as defined by Gregory and Miller (1998) is a process of generating new, mutually acceptable knowledge, attitudes, and practices. It is a dynamic exchange as disparate groups find a way of sharing common messages. It is a process of negotiation based on trust that leads to mutual understanding, rather than through statements of authorities or of facts. Hence, communication is necessary to enable stakeholders to participate in the social processes of debate and decision-making. "Science's new social contract with society" demands the participation of various stakeholders in knowledge generation and validation which is essential for the development of 'socially robust knowledge'. Hence, science and society transform each other (Gibbons, 1999).

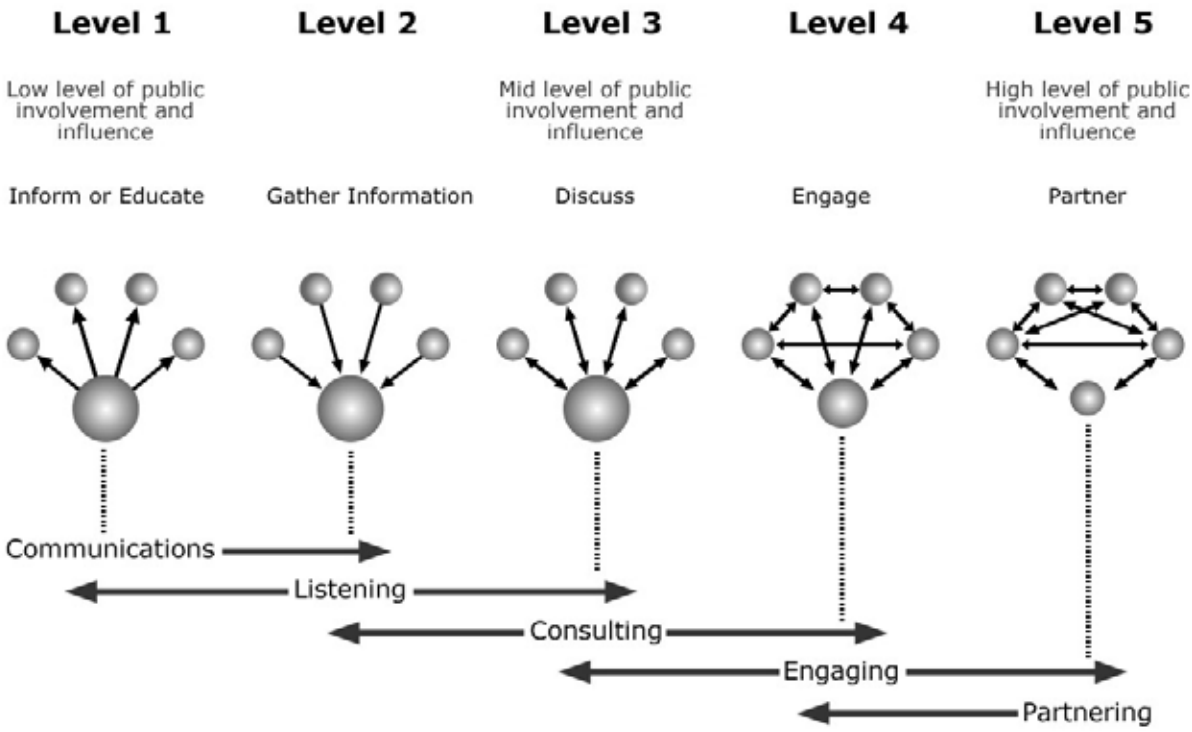
Science communication is therefore crucial in promoting an open and transparent debate about the potential risks and benefits of a new technology like biotechnology. This debate guarantees responsible use of the technology and assures stakeholders of having a choice or say in its adoption.

Canales (2007) cites the case of the European Union that has debated the issues of genetic modification (GM) for a long period and even enforced six years de facto moratorium on GM foods (1998-2004). This has vast implications for agriculture, research and development, and innovation not only in the European Union but also in individual member countries. It eroded scientific temper, and affected funding level and support for public biotech research. In addition, it contributed to the establishment of an overly cautious biosafety regulatory system that is unable to overcome impasses; and created a negative climate for investment by the private sector. As a consequence, the public developed negative opinion on GM crops as well as affected trade relationships, market acceptance, and delayed deployment of crop biotechnology in developing countries.

The case of many countries venturing into crop biotechnology show a general pattern of low public knowledge of biotechnology, distrust on the part of environmental groups, and government's slow action on regulatory support which is crucial for the technology to thrive. This scenario is compounded by lack of or inaccurate information, misinterpretation or over-simplification of facts. Cormick (2007) enumerates five factors that affect acceptance of biotechnology: information, regulation, consultation, consumer choice, and consumer benefit. In this scenario, it is important that adequate, science-based information is made available to various stakeholders to help them analyze issues, correct misinformation, and make early and informed decisions.

Brossard and Shanahan (2007) argue that "no cookie-cutter approach will suffice for developing an approach to understand how to communicate about biotechnology." Nevertheless, best practices are available. In order to improve the understanding of crop biotechnology and how its products may contribute to personal well-being, a strategic plan for public communications is required. Traynor et al. (2007) identify some specific objectives for public communication: make evident to decision-makers that modern biotechnology can be an effective tool for increasing agricultural productivity, and thereby economic growth, without imposing unacceptable risk to the environment or human and animal health; and enable members of the public to make informed decisions about appropriate uses of biotechnology by providing accurate information about benefits, risks, and impacts. Experiences can be shared to enable stakeholders to decide as to how, when and where biotechnology should be used.

Hence, there is a need for a multi-stakeholder process or dialogue to ensure public acceptance for crop biotechnology and in evolving enabling policies. A process of deliberation is expected between and among stakeholders to converge diverse ideas. Saner (2007) enumerates reasons why there is a need to involve the public, among which include: potentially improve public policy, a more informed and engaged public, more solid support for regulatory decisions, and greater public confidence in government.



Source: Health Canada's Public Involvement Continuum http://www.hc-sc.gc.ca/ahc-asc/pubs/public-consult/2000decision/pol-continuum_e.html. Health Canada. September 9, 2006. Reproduced with the permission of the Minister of Public Works and Government Services Canada, April 8, 2008.

Figure 1. *Levels of the public involvement continuum.*

Table 1. *Diffferent Levels and Methods of the Public Involvement Continuum*

LEVEL	TYPE	WHEN USED	PURPOSE	METHODS
1	Inform or educate	• Decision already made and public should know results • Need for acceptance of proposal before decision is made	• Concerns can be addressed with information; factual information helps understand policy or program	• Social marketing • Community mapping • Fact sheets • Information kits • Public awareness campaigns • Press release
2	Gather information	• Policy decisions still being shaped • Factual information is missing • Information on opinions is missing	• Anticipate communication challenges	• Meetings with stakeholders • Community or public meetings • Community or public meetings • Focus groups • Public hearings and seminars • Surveys
3	Discuss	• Need two-way info exchange • Input may shape policy directions, program delivery • Opportunity exists to influence final decision	• Want to facilitate discussion among stakeholders	• Bilateral meetings • Info technology-based methods (interactive website, electronic conferencing, online discussion groups, e-mail lists) • Issue conferences • Technical consultations • Workshops
4	Engage	• Citizens can shape policy directions • Citizens should talk to each other on complex, value-laden issues	• Opportunity for shared agenda setting and open timeframes • Options generated together will be respected	• Constituent assembly • Roundtables • Citizen’s panel
5	Partner	• Develop programs in partnership • Want to empower citizens or groups to manage process • Citizens or groups want to develop solutions themselves	• Agreement to implement citizen and groups solutions • Government ready for “enabler” role	• Consensus conference

Table summary developed from information in Saner, 2007

A policy for public involvement in decision-making can best be explained using a public involvement continuum illustrated in Figure 1 and elaborated in Table 1 (Health Canada, 2006; Saner 2007). Each level of public involvement and influence requires specific methods depending on the purpose of the initiative. For example, when a decision has already been made and the public needs to know about this, the objective of involvement is merely to inform or educate the public. Public awareness campaigns are thus appropriate at this level. On the other hand, a higher level of involvement is needed when it is necessary to empower groups to manage a process. In this level, consensus conference is a suggested method to meet the objective.

Medlock et al. (2007) identifies the following levels of communication to distinguish communication initiatives for specific audiences:

- Communication at the citizen-citizen level;
- Communication between citizens and experts;
- Communication as a catalyst for societal dialogue; and
- Communication for the policy-making sector.

Case in point is the social acceptance process of Bt maize in the Philippines.

The Case of Bt Maize in the Philippines

The approval of Bt maize in the Philippines in December 2002 was not without controversy. It was the first genetically modified food/feed product ever to be allowed for commercial planting in Asia, and therefore attracted enormous amounts of media and public attention both locally and internationally.

During the 7 years of the local evaluation of the technology, there was a continuous communication tug-of-war among the technology developers, the scientists, scientific organizations, advocacy groups/ non-government organizations, the farmers involved in the trials and the government sector. The debate in the Philippines continued from 1996 to 2002, and well after Bt maize was approved for planting and commercialization. The debate also saw a plethora of stakeholders, who included even the religious community, all trying to win the hearts and minds of the public and the government agencies assigned to assess the technology.

Some cause-oriented groups uprooted a field trial, sued the technology developers and lobbied for a moratorium on GM crops. A group of Catholic priests and nuns pleaded with local government units to refrain from giving support to GM activities in the community. Even politicians, including two senators, joined the fray by alleging that GM products could cause cancer and that it was a crime to do GM research. Filipino scientists battled it out with various groups in order to clarify the various concerns regarding the Bt maize technology.

Addressing the different concerns of such a diverse group of stakeholders became a real challenge, but was critical to the eventual commercial approval of Bt maize in the country.

-Excerpts from "The Bt Maize Experience in the Philippines: A Multi-stakeholder Convergence" in Brossard, D. et al.'s The Public, the Media, and Agricultural Biotechnology, 2007.

The Global Knowledge Center on Crop Biotechnology

The International Service for the Acquisition of Agri-biotech Applications' (ISAAA) Global Knowledge Center on Crop Biotechnology, familiarly known as the KC, was established in September 2000. It was established in response to an urgent demand from senior policy-makers in developing countries[1] for an entity that would make authoritative information available to facilitate and support transparent decision-making process regarding crop biotechnology. They noted that "the scarcity of current authoritative information and knowledge regarding food biotechnology crops represents a major deficiency that denies policy-makers and scientists access to the vital knowledge needed to make well-informed decisions." In particular, they concluded that:

- Consumers are generally ill-informed regarding agri-biotech crops and food. Anti-biotech groups mounting aggressive campaigns, initially in Europe and now globally, erode public confidence;
- Claiming their rightfully authoritative positions, the global science community, government regulators, and the agri-biotech industry must instill public knowledge and confidence through credible educational initiatives. Full awareness of the benefits, constraints, and attributes associated with food biotech crops belongs in the hands of developing nations – who stand to gain, or lose, the most;

[1] Six senior policy makers responsible for food biotechnology crops in ISAAA's client countries in Southeast Asia participated in a two-week Travelling Workshop in Europe and North America (Canada and USA) in September 1999. The Study Group was composed of Dr. Joko Budianto, Director General of the Agency for Agricultural Research and Development (AARD) in Indonesia; Dr. Hassan Bin Mat Daud, Director of the Malaysian Agricultural Research and Development Institute's (MARDI) Biotechnology Center; Dr. Rogelio A. Panlasigui, Undersecretary of Science and Technology in the Philippines; Dr. Sakarindr Bhumiratana, Director of the National Center of Genetic Engineering and Biotechnology (BIOTEC) in Thailand; Dr. Ruben L. Villareal, Chancellor of the University of the Philippines Los Baños; and Prof Vo-Tong Xuan, Vice Rector of the University of the Cantho, Vietnam and Rector of An Giang University, Long Xuyen City, Vietnam (Van Zanten, et al., 2000).

- Developing countries have been eclipsed in the dialogue on food biotechnology crops. Totaling more than 80 percent of the global population, the people of the Southern Hemisphere should be adequately represented in this critical global debate. Instead, vocal and affluent activists from the North - on both sides of the dispute - have dominated, sometimes taking a patronizing attitude towards their southern neighbors and generally not addressing the urgent needs of resource-poor, subsistence farmers in developing nations; and

- Developing countries lack current and authoritative information on crop biotechnology.

The Study Group recommended that ISAAA should "move quickly to implement its Global Knowledge Center on Crop Biotechnology. Great benefit will come from the consistent and focused distribution of knowledge in plain language through ISAAA's global network."

The ISAAA Southeast Asia Center which had already been in existence since 1997, was designated to be the hub of the KC. Along with the core KC officially set-up in September 2000, three initial Biotechnology Information Centers were established in the Philippines, Thailand, and Malaysia.

Building on the strength of ISAAA's commitment to start the information network, the KC buckled down to operationalize its mandate.

Expert planning workshop. In January 2001, some 24 experts from Asia (China, India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam); Africa (Egypt, Kenya, and South Africa); Europe (United Kingdom), Latin America (Brazil) and the United States of America were invited to a communication and network planning workshop in Bangkok, Thailand. The workshop sought to get a scenario of biotechnology in various parts of the world and assess the communication efforts being made; experts' perspectives on various communication activities; and communication design and implementation plan for specific BICs for the years ahead.

The country reports acknowledged that tremendous biotech activities were happening in the developing world but were not being reported. It was recognized that developing countries saw the potential of biotechnology to contribute to improved agricultural production. In addition, a common desire to collaborate and a shared vision from the country representatives formed a strong foundation for a network where countries from the developing world could share experiences regarding the technology. It was agreed that the BICs

flesh out their respective roles and activities based on specific information needs and identified stakeholders. The KC would then perform a facilitative role and provide tools and services to complement local activities, i.e. prototype communication materials, training, and coordination of information flow across the nodes.

Objectives. Based on the discussion in the workshop and a brainstorming exercise with experts, the identified objectives of the KC were to:

- Serve as a global knowledge center and network on crop biotechnology;
- Assist national biotech programs in creating an enabling environment for the safe application of crop biotech, through the creation of Biotechnology Information Centers (BICs);
- Generate, process, and package knowledge on crop biotech;
- Facilitate sharing of knowledge among various stakeholders; and
- Develop and validate appropriate science communication modalities.

Primary stakeholders. The 2001 network meeting identified the KC's four sectors to be reached: non-government organizations, media, health/nutrition specialists, and national scientists. Eventually, the KC's primary audience evolved to include policy-makers, the academic community, and the private sector.

Several countries are in very different stages in the process of adopting GM crops. Some are still evolving biosafety guidelines to be enacted into law and thus policy-makers, the academe, and scientists continue to be the main focus of communication efforts. Policies have to be put in place by governments that are science-based and free from emotional or ideological biases in order to deliver desired benefits. Through the KC's network of BICs, specific audiences in each of the member countries are identified including farmers and industry, with the 'general public' eventually reached via the multiplier effect of communication.

Organizational set-up. The KC is under the direct guidance of the ISAAA Global Coordinator/ Southeast Asia Center Director, who in turn is accountable to the ISAAA Board of Directors. A manager oversees program implementation and is supported by a multi-disciplinary team. Activities are implemented based on a team approach with each individual contributing his/her share in the attainment of specific objectives.

Activities. In carrying out its objectives, the KC is involved in various activities that span global knowledge networking; information needs analysis and strategy design; information repository building; and information packaging. Specifically, these include:

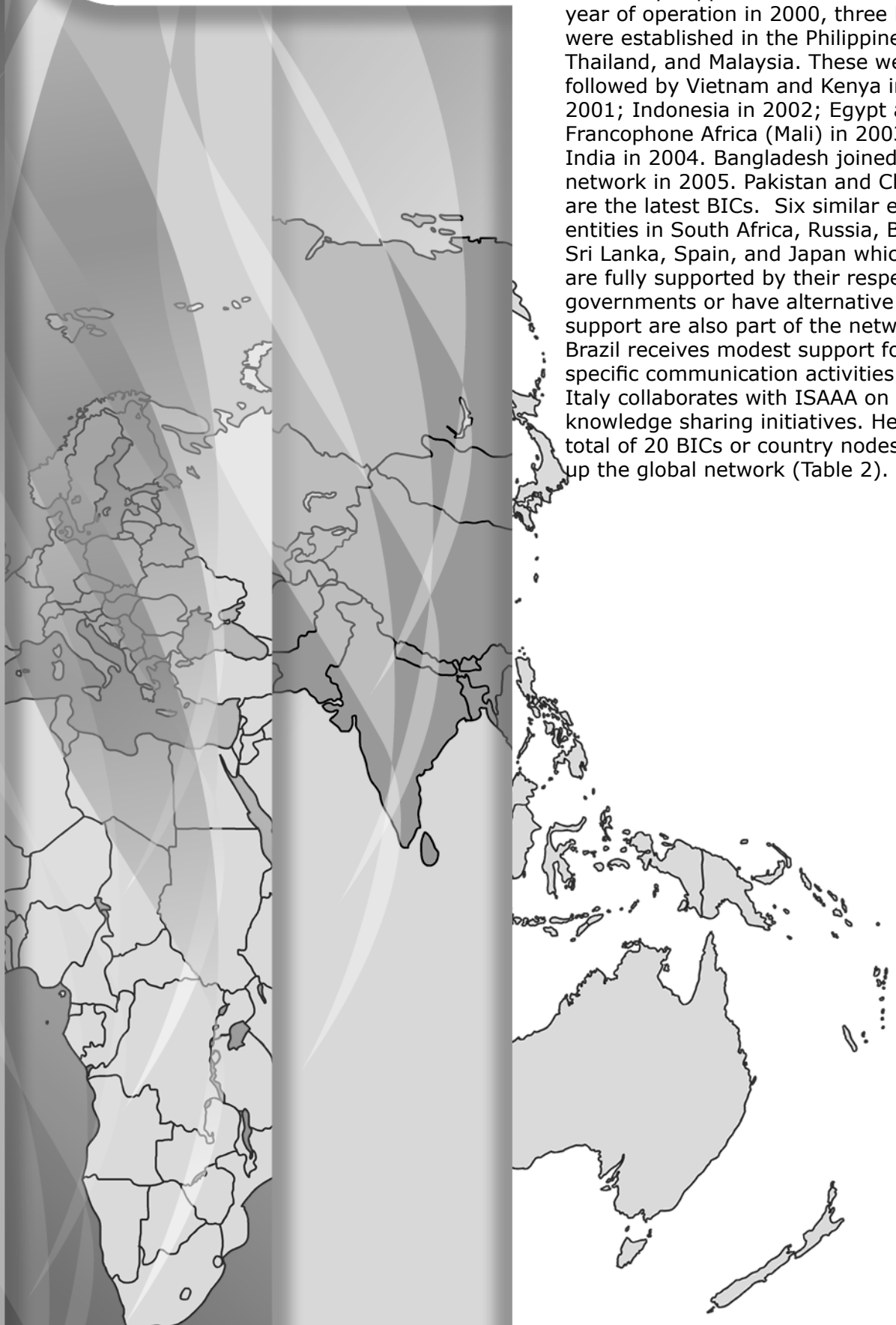
- Environmental scanning – involves consolidating information about issues and concerns that affect stakeholders regarding biotechnology;
- Coordination and monitoring of a global network of BICs and linking with key institutions;
- Global outreach through Internet-based applications – development and updating of a website and its two e-newsletters, Crop Biotech Update and Biofuels Supplement;
- Publication design and development –production of various print materials from brochures, semi-technical publications, monographs, and Briefs, as well as submission of articles to peer-reviewed publications;
- Video documentation - development of video series on experiences of developing countries with regard to biotechnology applications;
- Development of other communication tools such as board games, mentor kits, radio plugs, exhibits, and CD ROMs on information resources;
- Capacity building of stakeholders – design and implementation of workshops, seminars, and other outreach activities;
- Communication research – conduct of studies to better understand knowledge levels, attitudes,

and viewpoints of stakeholders, either as an audience or a user of communication materials; and

- Special projects – involvement in external communication activities requested by development partners and specific groups.

The KC has a global mandate and hence, focuses on the macro perspective of the biotechnology arena. It critically scans global developments and analyzes issues and concerns to come up with implications for developing countries. This information is transformed into prototype communication strategies that stakeholders will find useful for decision-making. It is the network of Biotechnology Information Centers, however, that cater to specific information needs of local stakeholders.

IV Biotechnology Information Centers (BICs)



The heart and soul of the Global Knowledge Center on Crop Biotechnology (KC) is its growing network of Biotechnology Information Centers (BICs) or country nodes in Africa, Asia, Europe, and Latin America. At the moment, the KC has a network of 12 fully supported BICs. In the initial year of operation in 2000, three BICs were established in the Philippines, Thailand, and Malaysia. These were followed by Vietnam and Kenya in 2001; Indonesia in 2002; Egypt and Francophone Africa (Mali) in 2003; and India in 2004. Bangladesh joined the network in 2005. Pakistan and China are the latest BICs. Six similar existing entities in South Africa, Russia, Bulgaria, Sri Lanka, Spain, and Japan which are fully supported by their respective governments or have alternative funding support are also part of the network. Brazil receives modest support for specific communication activities while Italy collaborates with ISAAA on its knowledge sharing initiatives. Hence, a total of 20 BICs or country nodes make up the global network (Table 2).

Table 2. *Summary of Biotechnology Information Centers or Country Nodes*

REGION	COUNTRY	OFFICIAL NAME	HOST INSTITUTION	YEAR
ASIA	Philippines	SEARCA Biotechnology Information Center (SEARCA BIC) URL: http://www.bic.searca.org/	Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Los Baños, Laguna	July 2000
	Thailand	Biotechnology and Biosafety Information Center (BBIC) URL: http://www.safetybio.com/	College of Agriculture Kampaengsaen, Kasetsart University, Nakhon Pathom	July 2000
	Malaysia	Malaysian Biotechnology Information Centre Berhad (MABIC) URL: http://www.bic.org.my	Monash University Malaysia Jalan Lagoon Selatan, Bandar Sunway, Petaling Jaya, Selangor	December 2000
	Vietnam	Agbiotech Vietnam URL: http://www.agbiotech.com.vn/vn/	Science and Technology Information Service AgBiotech Vietnam, Trung Yen New City, Trung Hoa Precinct, Can Giay District, Hanoi	November 2001
	Indonesia	Indonesia Biotechnology Information Center (IndoBIC) URL: http://indobic.biotrop.org/	Southeast Asia Regional Centre for Tropical Biology (SEAMEO BIOTROP), Bogor	October 2002
	India	ISAAA South Asia Office	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), NASC Complex, Dev Prakash, Shastri Marg, New Delhi	August 2004
	Bangladesh	Bangladesh Biotechnology Information Center (BgBIC) URL: http://www.bgbic.org	Bangladesh Agricultural University, Mymensigh	February 2005
	Pakistan	Pakistan Biotechnology Information Center (PABIC) URL: http://www.pabic.com.pk	International Center for Chemical and Biological Sciences, Latif Ebrahim Jamal Research Institute of Chemistry, University of Karachi, Karachi	June 2006
	Sri Lanka*	Biotechnology Education and Information Center (BEIC) URL: http://www.slbic.org	Department of Plant Sciences, Colombo University, Colombo	June 2007

Table 2. *(continued)*

REGION	COUNTRY	OFFICIAL NAME	HOST INSTITUTION	YEAR
ASIA	China	China Biotechnology Information Center (CABIC)	China Biotechnology Society Beisihuan Xi Lu, Zhong Guan Cun, Beijing, Peoples Republic of China	February 2008
	Japan*	Nippon Biotechnology Information Center (NPBIC)	NPO Hokkaido Bioindustry Association (HOBIA) c/o Hokkaido Collaboration Center, Sapporo, Japan	April 2008
AFRICA	South Africa* (node)	AfricaBio URL: http://www.africabio.com	AfricaBio, Centurion, Pretoria	January 2001
	East and Central Africa (c/o Kenya)	East and Central Africa Biotechnology Information Center (ECABIC) URL: http://africenter.isaaa.org/	ISAAA *Afri*Center, c/o International Potato Center (CIP), International Livestock Research Institute (ILRI) Campus, Nairobi	July 2001
	Egypt	Egypt Biotechnology Information Center (EBIC) URL: http://egypt-bic.com	Agricultural Research Center, Agricultural Genetic Engineering Research Institute (AGERI), Giza, Cairo	March 2003
	Francophone Africa (c/o Mali)	Mali Biotechnology Information Center	Institut d'Economie Rurale (IER), Bamako	June 2003
EUROPE	Russia*	Russian Biotechnology Information Center (RUBIC)	Centre for 'Bioengineering' Information Division on Biotechnology, Russian Academy of Sciences, Moscow	January 2004
	Bulgaria*	Bulgaria Biotechnology Information Center	AgroBioInstitute, Dragan Tsankov Blvd., Sofia	January 2004
	Spain*	The Center for Information on Biotechnological Innovations /El Centro de Informacion en Innovacion Biotechnologica (IBERCIB) URL: http://ibercib.es	Ibercaja, Zaragosa	April 2007
	Italy (node)*	Fondazione Bussolera Branca	Fondazione Bussolera Branca, Mairano di Casteggio	January 2008
LATIN AMERICA	Brazil (node)+	Celeres	Celeres Eng Helvio Felice, Uberlandia, Minas Gerais, Brazil	October 2007

*Fully funded by their governments or have own funding sources
+Funding provided by ISAAA for specific communication projects

Figure 2. *Map of Global Knowledge Center on Crop Biotechnology and BICs*

ISAAA also maintains links with other groups such as the Burkina Biotech Association in Burkina Faso, and Echos du Sahel in Niger. Figure 2 presents a graphical representation of the network.

Objectives. In general, the BICs are at the forefront of responding to scientific information needs, and in promoting and advancing a broader public understanding of crop biotechnology in their respective countries. They are now recognized in their respective countries as a major source of crop biotechnology information.

The BIC in the Philippines is hosted by a regional organization that covers Southeast Asia. It states its main goal as addressing the needs of the Southeast Asian region for a highly credible, sound, and factual biotechnology information resource center which is accessible to various stakeholders. Specifically, its objectives are to:

- Serve as a hub of the regional network for current science-based information on agricultural biotechnology;
- Support national programs on agricultural biotechnology by providing strategic information for decision-making;
- Act as information broker among various stakeholders;
- Coordinate with regional and national network nodes on the exchange, processing, packaging and distribution of agricultural biotechnology information; and
- Synthesize and package science-based information using appropriate formats for various stakeholders.

Other BICs follow similar objectives attuned to specific country-specific information needs and stakeholder requirements. It is important to note that each BIC has flexibility to plan realistic objectives to increase the chance of success in meeting set goals. From the general statement of objectives, each BIC is encouraged to formulate more specific, achievable, and measurable ones.

Stakeholders. The identification of priority stakeholders is based on the specific realities and conditions as well as information needs in a particular country or region. However, the primary audience consists of scientists, academics,

policy-makers or opinion leaders, media, government authorities and the private sector. Due to the multiplier effect of communication, the 'general public' is eventually reached. A survey of information channels in some countries suggests the need to reach out to faith-based and other religious officials who are also perceived as sources of information.

Since the state of biotechnology and stakeholders' interests and information needs vary, identifying and prioritizing the different publics or audiences must be a top concern. Thus from a working concept of a 'general public,' it is necessary to consider sub-groups, each of whom needs specific information requirements, and communication styles and formats. It is important to customize communication strategies for these audiences to maximize impact.

Table 3 is a guide to determine potential targets and specific needs using some examples advanced by Lisa Watson (2002).

Institutional arrangement. Fully-funded BICs are hosted by either public or private institutions to enable them to integrate with the local system, receive administrative and logistical support, and provide a home base for operations. Some of the BICs are hosted by international organizations based in the mother country. Examples are the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) which hosts the Philippine BIC, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) for India, Southeast Asia Regional Centre for Tropical Biology (BIOTROP) for Indonesia, and International Potato Center (CIP) for Kenya. Academic institutions host other BICs such as Monash University (Malaysia), and Bangladesh Agricultural University, while government research and development institutions also host BICs such as in Egypt, Mali, Pakistan, and Thailand.

A newly established BIC seeks a host institution that would provide the best support for its existence. Often, a host institution that supports the objectives of the BIC and provides logistical support with minimum bureaucratic limitations is chosen. In the case of some BIC heads that are affiliated with some institutions, i.e. academic or research and development agency, the choice is often dictated by this situation.

A Memorandum of Agreement is signed between the host institution and ISAAA to formalize the organizational arrangement. Based on the level of integration into the system, the BIC can either be made part of the host institution as exemplified by the case of the Philippines or as an independent entity paying rent and support services to the host institution such as those in India and Kenya. In the case of Malaysia, it is hosted by a private university but has decided to gain legal status in the country as a non-profit organization to source external funding support.

Philippines

The host institution of the Philippine BIC is SEARCA. In 2000, it convened a Regional Conference on Agricultural Biotechnology in Bangkok, Thailand to discuss a regional "enabling environment" for an effective and safe utilization of agricultural biotechnology in Southeast Asia. The participants, composed of policy-makers, senior scientists and officials from both government and the private sectors, recommended support for capacity building, international cooperation, and information sharing.

At about this time, ISAAA had also just conceptualized the Global Knowledge Center on Crop Biotechnology, an information network. The directors of SEARCA and ISAAA agreed to establish a biotechnology information center. Organizationally, the BIC is now part of the Knowledge Management Unit of SEARCA and has in addition to its BIC functions, duties to support the objectives of the host institution.

India

ICRISAT was identified as a host due to its commitment to biotechnology and the willingness of both heads of agencies to support the knowledge sharing initiative. ICRISAT provides administrative support services in addition to leasing space for the BIC's office and the use of office amenities such as network connectivity and communication facilities. The

Table 3. *Characteristics of Some Potential Information Center Targets*

POTENTIAL TARGETS	IMPORTANCE OF TARGET	NEEDS OF TARGET
Media	• Most effective means of reaching consumers	• Business, agriculture, health, and consumer media interested in aspects of biotechnology • Need to provide succinct, easily accessible, usable, referenced, timely biotech information
Academics	• Frequently used as resource by media	• Need technical information to ensure they understand and can stand behind the science beyond their specific area of expertise • Often need coaching on translating technical information into terms that the public can understand
Government bodies	• Appropriate groups within the government need to be aware of consumer education initiatives • Government bodies will be interested in developments and commitments to biotechnology both in-country, as well as in other parts of the world	• Information from the government on regulatory approach, safety assessment, research initiatives and other relevant information are important parts of outreach programs
Food/Feed Industry	• This broad category includes all groups from farm to plate, from growers to producers and processors to retailers • The food/feed industry is very much affected by developments in biotechnology, so it is critical that they understand ongoing initiatives that may impact public awareness	• The food/feed industry should be aware of consumer education materials and initiatives that can help them respond to questions from and the needs of their ultimate customers • In some cases, segments of this category are willing to participate in or share information that will be helpful to the overall educational initiative
Consumers	• Consumers are the ultimate target of educational outreach efforts, but it is likely to be more cost-effective to reach them through the groups identified above rather than directly	• Materials need to be written in simple, easy-to-understand language, without jargon

Source: Lisa Watson, 2002

Memorandum of Agreement, signed by the heads of both institutions likewise stipulated ICRISAT's facilitation in the appointment of an ISAAA National Coordinator, creation of an Advisory Committee, and provision for assistance in ISAAA activities. The MOA enabled collaborative activities to be organized with ICRISAT such as media workshops where experts are tapped to be resource persons, and the publication of a book on writing for crop biotechnology.

Malaysia

A non-government organization called Tropical Fanfare Berhad initially performed the tasks of a BIC in Malaysia but was eventually hosted by an academic institution. Monash University Malaysia was deemed as a better alternative since the university was conducting both education and research in biotechnology and that by working together, could lead to "outputs of higher impact at minimized duplication and reduced costs." Hence, a Biotechnology Resource Center was set-up. The Memorandum of Agreement, signed by the Monash Pro-Vice Chancellor and the ISAAA Director, stated that Monash would provide in-kind support by hosting the Center and providing an appropriate office at its campus; appoint the staff; and assist in creating an Advisory Committee to guide the Center. Five years later, the BIC decided to register MABIC as a non-profit organization ("company limited by guarantee and not having a share capital") to operate for educational and scientific purposes, particularly to facilitate the transfer of agricultural biotechnology applications from industrial countries for the benefit of Malaysia; assist Malaysia to assess the benefits and risks of the technology, including environmental and biological safety; and to promote, arrange, organize and conduct conferences, meetings, discussions, seminars and research. This legal arrangement thus enables MABIC to solicit and receive additional funding or resources to meet its objectives.

Egypt

The government's Agricultural Research Center's Agricultural Genetic Engineering Research Institute (AGERI) hosts the BIC. AGERI's mission is to develop a biotechnology center that "has a high credibility as a sound, factual resource among leaders, government officials, the media and the public" and through the network it forms can serve as the focal point for agricultural biotechnology education outreach initiatives. The Memorandum of Agreement signed by the Vice President Supervisor of AGERI and the ISAAA director, stipulates that AGERI would thus provide in-kind support by hosting the Center, appoint the staff, and determine the composition of its External Advisory Committee.

Other Countries

For BIC-like entities which do not receive funding, a proposal to be part of the network is given to ISAAA for consideration. Sri Lanka, Bulgaria, Russia, and Japan for instance, rely on collaborative partners like ISAAA which is committed to share information resources. AfricaBio in South Africa shares a common goal of providing accurate information on biotechnology to key stakeholders and providing regular fora for exchange of information. Through a Letter of Agreement signed by the heads of AfricaBio and ISAAA, it was agreed that AfricaBio in being part of the network, serves as a point of contact for biotechnology and biosafety communication and information activities in South Africa. In turn, ISAAA provides information materials in electronic format for the use of AfricaBio for translation and dissemination purposes. When there are common or specific projects or activities, however, agreements can be made to share costs. In the case of Sri Lanka, the BIC is a collaborative effort with several partners. The University of Colombo provides office space, faculty, and resources; and the Michigan State University sponsors biotechnology specialists for in-country training courses and assists in the development of online courses and modules. ISAAA in turn, contributes biotech information resources.

Funding sources. ISAAA provides a core budget for the BICs that it fully supports. This budget is based on donor allocations, hence, some BICs might receive more than others because of the perceived importance of initiatives or identified activities in certain countries. Funds are allocated for specific projects

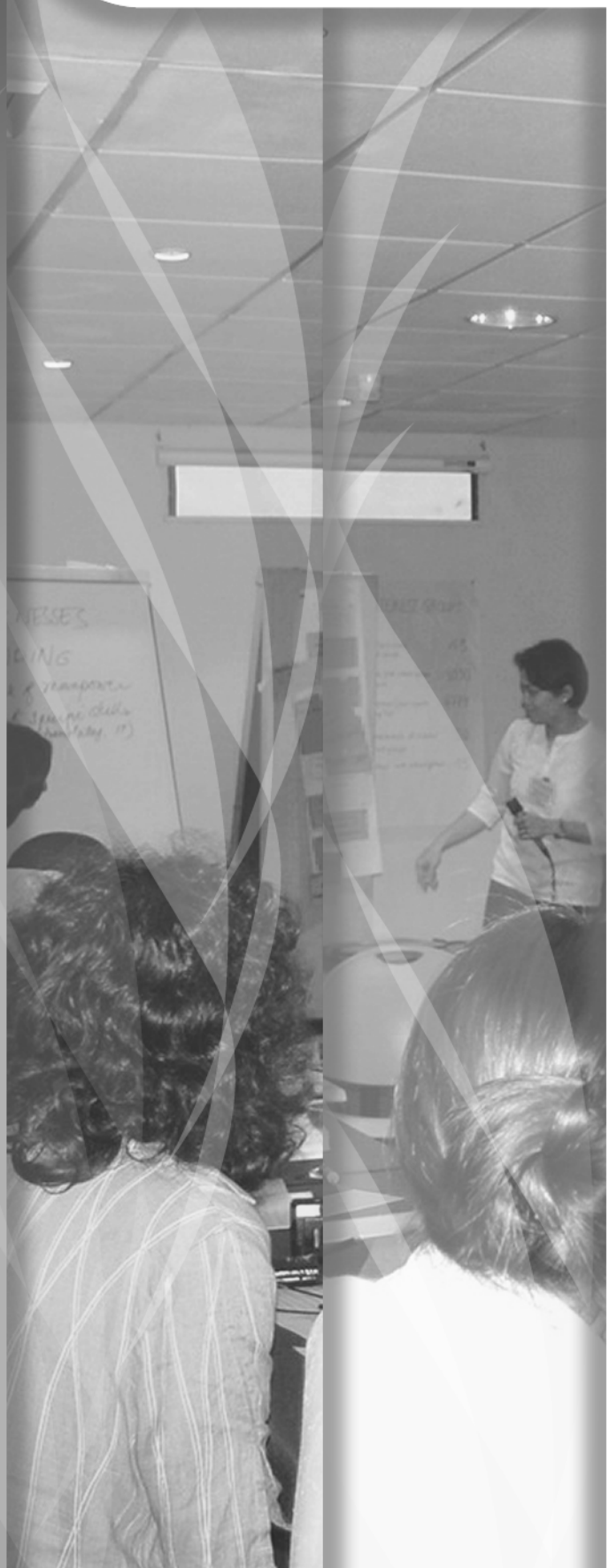
such as information dissemination and networking activities as well as workshops and seminars. In augmenting resources, BICs are encouraged to submit proposals to other public and private institutions to co-fund projects. Resources can be non-monetary or in kind such as workshop venue, meals, supplies, and resource persons. Funding can be specific for certain activities such as the conduct of workshops, development of a publication, or a study visit.

Personnel. Most of the fully-funded BICs are headed by a competent person with a title like Executive Director, Network Administrator, or National Coordinator who work full-time on the job. Other BIC heads work part-time in addition to a full-time job with the host institution. For example, a BIC head works concurrently as a full-time professor or as a deputy director of the host institute. The BIC head supervises and oversees the operations of the Center. He/she is assisted by an additional full-time staff or part-timers who are employees of the host institution. The staff might be a writer, website developer or performs multiple tasks. In case of special activities, some BICs employ student assistants or request collaborating institutions for manpower during activities such as workshops and seminars.

Activities. Cognizant of specific conditions in each of the country coupled with level of awareness, and political and cultural differences, the individual BIC is at liberty to determine the best combination of communication strategies that would efficiently accomplish its main objective of fostering a science-based debate on crop biotechnology. Major activities of the BICs include networking with key stakeholders, workshops and outreach activities, and translation and development of communication materials using the tri-media including electronic mode. Minimum outputs include a profiled mailing list of subscribers/recipients of communication outputs, submission of news for the weekly e-newsletter Crop Biotech Update, and translation of publications.

An understanding of the context of communication, biotechnology, and the environment in which they thrive segues to the detailed process and concerns of biotechnology communication.

V Understanding Stakeholders



In order to guide the Global Knowledge Center on Crop Biotechnology (KC) and the Biotechnology Information Centers (BICs) in planning for specific communication strategies, it is important to understand their various audiences and how they respond to issues and concerns about crop biotechnology. Some of the methods for determining public perception include focus groups, surveys or stakeholder analyses, and media monitoring. A review of secondary data, i.e. publications, reports, and proceedings, is also important to "scan the environment" to assess developments in crop biotech.

The focus group or group interview is a strategy for understanding audience attitudes and behavior. It enables a clearer understanding of identified stakeholders. Based on the objective of the exercise, a small group of people (6-12) are gathered together and insights are obtained by carefully asking key questions. A moderator leads the group in a relatively unstructured discussion about the main topic. Answers to the questions are validated with the rest of the group to gather a more general perspective of public opinion. In formulating objectives and activities of the KC during its initial year, a small group of experts were invited to brainstorm concerns such as scope of involvement and audience prioritization.

Survey. Public perception and attitude surveys provide sources of benchmark information and glimpses from findings that are "mined" and analyzed. These can be implemented through mail, telephone or internet surveys. Personal (face-to-face) interviews can also be done where a respondent is invited for a one-on-one dialogue. These strategies have their own advantages and disadvantages but Wimmer and Dominick (2006) noted that from their experience in the United States, personal interviews have a 40 percent response rate, telephone surveys 10 to 75 percent, Internet 1 to 30 percent, and mail surveys 1 to 4 percent. ISAAA's experience in using e-surveys shows a 0.5 percent return. While this percentage of return may seem insignificant, the survey gives a profile of readers and provides varied feedback.

ISAAA in collaboration with the University of Illinois conducted a five-country

study in 2002 to determine public understanding, perception, and attitude towards agricultural biotechnology. Representing the public as stakeholders were eight sectors, namely, policy-makers, journalists, scientists, farmer leaders and community leaders, extension workers, consumers, businessmen and traders, and religious leaders. Responses were sought to the following questions:

1. What do stakeholders generally know or understand about agricultural biotechnology?
2. What are their views and opinions about the impact and role of biotechnology in their lives?
3. Where do they obtain information and what information or message contents do they get?
4. Who do they trust to tell the truth about biotechnology?

A follow-up study was conducted in 2005 in collaboration with the College of Development Communication of the University of the Philippines Los Baños to identify the prevailing trends concerning public understanding and perception of and attitude towards biotechnology in the Philippines and Indonesia. This study sought to describe the socio-cultural characteristics of the various stakeholders in agricultural biotechnology; identify their information sources; find out their understanding and perception of and attitude towards agricultural biotechnology; and determine the relationship between socio-cultural factors and stakeholders' understanding and perception of and attitude towards agricultural biotechnology.

A structured interview schedule was used to gather data although in the case where respondents such as policy-makers were not available for interview, self-administered questionnaires were used instead. The BICs were tapped to conduct the interviews for the specific country being studied. However, to answer specific audience concerns, the BICs can conduct their own surveys using a set of basic questions to provide benchmark data and validate assumptions for planning purposes. A literature review of public opinion studies is also useful to determine public understanding and attitude over time. What then did the surveys reveal that can help in making a communication plan? It validated the need for communication efforts as knowledge on biotechnology was low to moderate. Scientists were identified as credible and trusted sources of information while media was a source for many respondents on crop biotechnology (View the ISAAA survey at http://www.isaaa.org under the ABSP II section).

Media Monitoring. The news media can set the agenda for the public's attention to issues around which public opinion is formed. Hence, it is important to analyze what media considers important enough to write about. Media monitoring involves the "systematic register and review of what the media tells about the world" (Nordenstreng, 2001). BICs or network contacts scan national papers daily and analyze articles on crop biotechnology based on number of articles, topic of article, and tone (positive, negative, neutral). Other variables that can be analyzed include source of information cited by article, and biotechnology theme or story angle (cultural, economics, religious, political). Some of the questions that this study answers include:

1. What agri-biotech news stories come out in national newspapers during a given period of time?
2. What is the content (topic, common theme and tone) of news coverage for agri-biotech during the period of analysis?
3. Who is the source of the article?

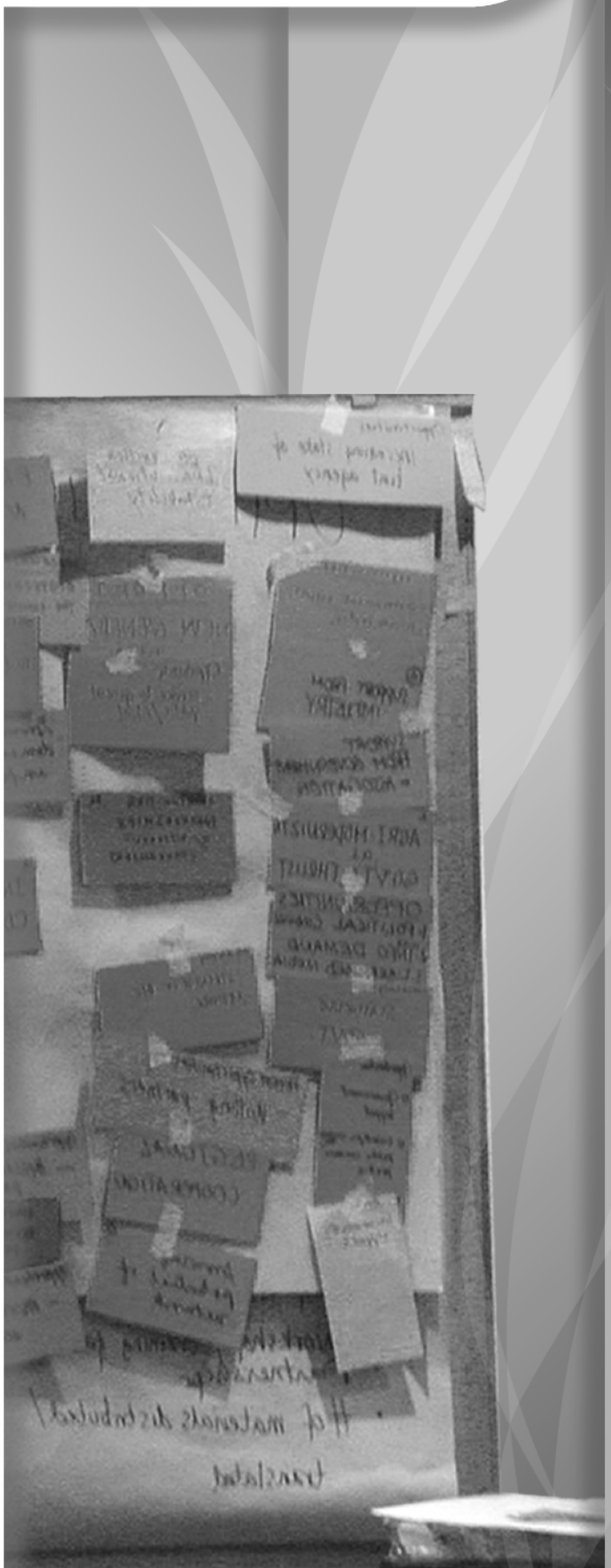
Data gathered over time enables an understanding of what media considers as news so that the BIC can proactively react or anticipate media requests and coverage for agri-biotech articles. It also provides an idea of information sources so that the BIC can determine if it should increase its media visibility. Data from the Philippines, for instance, show that biotech news are covered by most national newspapers, although majority of articles are covered by the top three newspapers in the country. Navarro and Villena (2004) analyzed data from a media monitoring study in the Philippines. They found that an average of 25 articles was published monthly with majority of articles positive

in tone, supportive of government and private sector initiatives, and guided by social/cultural interest. The favorable media environment exists for agri-biotech in the Philippines even in 2008 data. In 2007, selected provincial or regional newspapers and online versions were also monitored. Initial results show that these local newspapers did not publish as many articles as broadsheets with the few articles mostly about low end biotechnology. This suggests the need to provide local papers with possible stories and or include them in media training programs and study tours.

A five-country monitoring study conducted by ISAAA in India, Malaysia, Philippines, South Korea, and Vietnam in 2003 showed sustained media coverage on crop biotechnology. Local journalists were writing about biotechnology and followed developments of important newsworthy milestones such as the approval of a GM crop as in the case of the Philippines and India.

Different methodologies are available to help establish a basis or foundation for understanding stakeholders. With a clear picture of the environment and users of information, the communication process can now be discussed in detail.

VI Designing a Communication Plan



A communication plan is a roadmap that charts the directions that an organization will take to reach its objectives. It is an important component to achieve goals that ensure organizational success. Among the reasons for the development of a communication plan is to clarify goals and objectives; explain relationships between audiences, messages, channels, and activities; identify accountabilities and deliverables; and evaluate outputs vis a vis objectives and goals.

Traynor et al. (2007) propose some preliminary tasks that have to be completed before preparing a strategic communications plan. These include the need to:

- Establish a working group to develop the communication plan. It can be composed of members with expertise in biotechnology and biosafety, communication, and project management;
- Identify scientists and technical experts who are knowledgeable about biotechnology, crop breeding, and related fields. The team can provide an overview of the science, the products available and those being developed, and safety issues and concerns;
- Analyze local and national information initiatives in the subject matter area to determine what strategies work and what does not, in terms of effective information delivery to specific audiences; and
- Conduct survey research to establish baseline data on current public perceptions about biotechnology to determine knowledge gaps.

A communication plan has greater potential for sustainability if it is developed *with* rather than *for* various stakeholders. This participatory approach enables a critical understanding of the social environment, a sensitivity to the needs and priorities of specific audiences, and a focused direction based on real time concerns. This systematic and strategic process encourages people to come together and cooperate, as well as initiate action on their own volition. A communication plan is never static or fixed but a dynamic, evolving one.

There are five important steps in implementing communication activities. The process is cyclical, as it involves a continuous flow of reassessment and refinement. Information obtained from the evaluation can be fed back to assessment and thus the process starts over again. Versoza (2003) enumerates these steps as:

Assessment. This stage involves obtaining information to guide the communication strategy. It identifies the behaviors desired, key messages, audiences or stakeholders to reach, the communication channels to reach the audience, and specific units to implement the communication activities.

Planning. A clear course of action is determined on the basis of the assessment earlier done. Decisions are made with regard to desired behaviors, key messages, audiences, communication channels, and activities including supporting elements such as budget, timeline, communication research plan, and a capacity building component.

Material development and pretesting. Production of communication materials entails working with the audience to develop messages that will be effective with them. Hence, messages must be clear and easy to understand, and culturally sensitive. Pre-testing of materials guarantees that materials developed for dissemination are designed for specific, identified stakeholders.

Implementation. This step involves distributing print material, broadcasting and television messages, and conducting interpersonal forms of communication. The delivery and distribution of communication materials whether through print, radio or television, or through interpersonal communication means depends not only on quality and timeliness, but also on availability of good supporting services.

Monitoring and evaluation. These are carried out simultaneously with implementation to determine audience response to messages, and subsequent changes in knowledge, attitudes, beliefs and practices. This process enables mid-course corrections and identifies new opportunities to improve the communication component. The final evaluation enables learnings to be used for future communication programs.

W.K. Kellogg Foundation's Communications Toolkit provides a downloadable template from its website for a strategic communication plan that was created to help organize ideas, outline objectives,

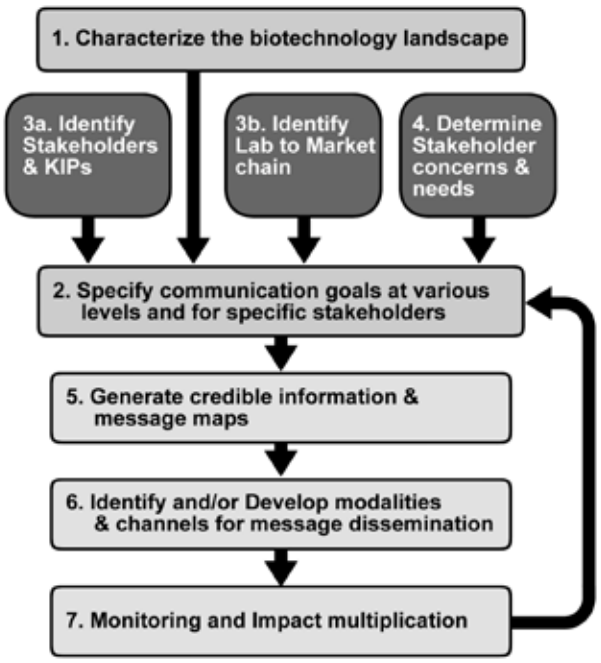
Table 4. Sample Questions in Developing a Communication Plan.

ELEMENT	SAMPLE QUESTIONS
1. Determine Goal	What issue is most important to your organization now? Who is most affected by the issue? Who makes decisions about the issue? What is the overall goal you want to achieve? What tangible outcomes would you like to achieve through a communication effort?
2. Identify and Profile Audience	Of your identified audiences, whose knowledge, attitudes and behavior must be changed in order to meet your goal? (primary audience) Who else is affected if you succeed in your goal? (secondary audience) What are the characteristics of this audience?
3. Develop Messages	What change in attitude (or how one feels about an issue) do you want to motivate in your audience to meet your goal? What change in the behavior (day-to-day actions do you want to achieve? What are the three most compeling sentences you could use to motivate your audience?
4. Select	Where or from whom does this audience get its information? Who do they find credible? Where does this audience spend most of its time?Where are they most likely to give you their attention?
5. Choose Activities and Materials	What are the activities, events and or materials to be used in your selected channels that will most effectively carry your message to the intended audiences?
6. Establish Partnerships	Who can support or work with your audiences or share in your goals? What role will they play?
7. Implement the Plan	What are the activities to be done and the steps that will lead to its completion? What is the time table to accomplish the activities? What is the budgetary estimate for each activity?
8. Evaluate and Make Mid-Course Corrections	What are the strengths and weaknesses of the plan? What are the obstacles? What new approaches can be implemented for success?

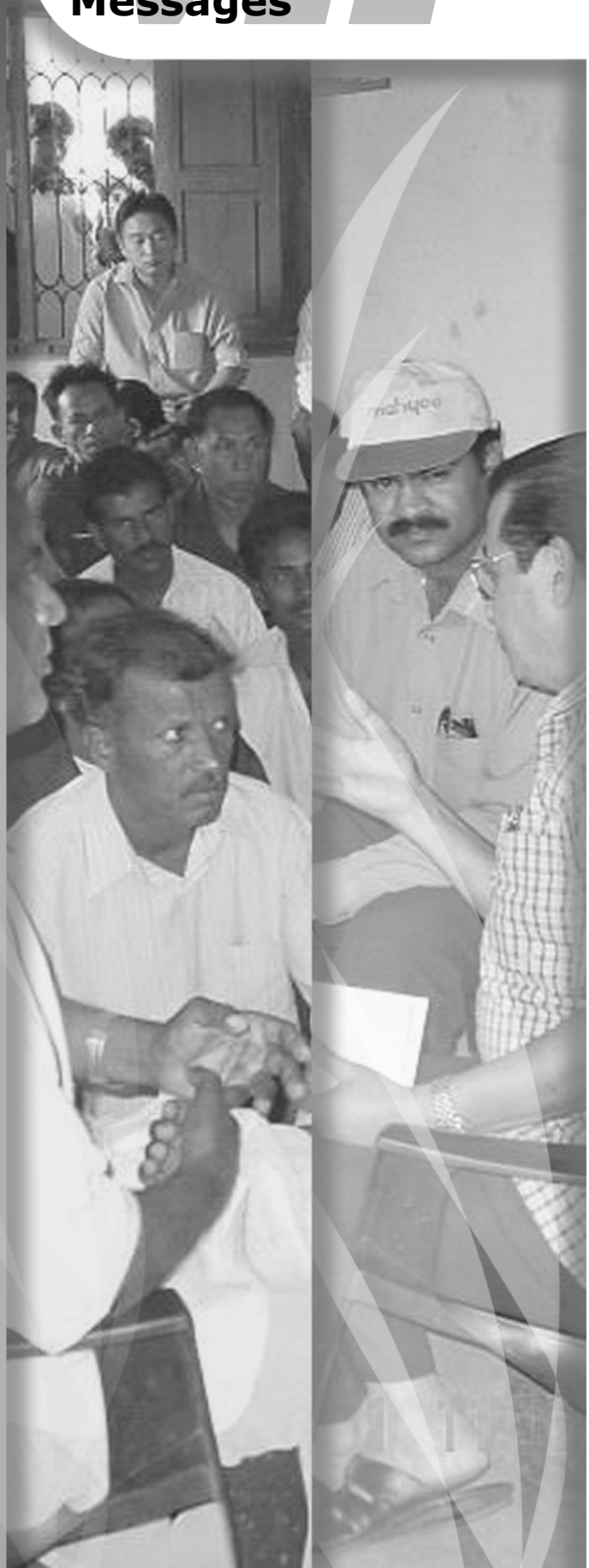
Source: W. K. Kellogg Foundation's Communication ToolKit
http://www.wkkf.org/Default.aspx?tabid=90&CID=385&ItemID=5000034&NID=5010034&LanguageID=0.
Permission to use information granted by W.K. Kellogg Foundation on May 8, 2008.

and create strong and strategic messages. It recommends questions for each element of a strategic communication plan. Sample questions that need to be answered are presented in Table 4.

From a similar perspective, Teng (2001; personal communication, July 18, 2008) reiterates the important steps in a biotechnology communication model. The process shows the flow of required actions to assure the success of communication endeavors: characterize the biotechnology landscape, specify communication goals, identify stakeholders and key influence persons (KIPs) and their concerns, generate credible information, identify modalities for message dissemination, and monitor impact. Information from monitoring activities will validate communication goals and thus allow for modifications if necessary.



VII Identifying Key Messages



A strategic communication plan done in collaboration with key stakeholders is an important step in building public support. Equally important is identifying key messages. Closely tied to goals and objectives, messages give important information about issues and encourage specific audiences to respond accordingly. Messages show the importance or relevance of an issue, and connect values and beliefs of specific audiences.

The International Food Information Council has 10 communication tenets for consumer acceptance of food biotechnology. They are suggested for any opinion leader charged with communicating food biotechnology issues to the public. Examples of these tenets are (Benson, 2007):

- The purpose for each new product of food biotechnology and its consumer benefits must be explained clearly at the beginning of public discussion;
- Biotechnology must be placed in context with the evolution of agricultural practices;
- Communications should emphasize the exhaustive research over many years that led to the introduction of each new product of food biotechnology; and
- Government and industry communications on food biotechnology must be consistent in order to earn consumer confidence.

Andy Benson (personal communication, June 16, 2008) said that the overall goal of the communications tenets is to help and encourage key, credible stakeholders, experts and officials to work together to provide the food chain and the consumer with a balanced view of biotechnology that is solidly grounded in the current science and in the known facts regarding its development. This way, one builds a broad body of knowledge, and a broad platform for its dissemination to people who need to know and to people who want to know.

Seminars and workshops organized by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) identified

"burning issues" in biotechnology that need to be addressed (Navarro et al., 2006). These are:

- How can agri-biotechnology help attain global food security and alleviate poverty?
- What are the social and economic benefits of agri-biotechnology?
- What are the regulations in assuring public safety on genetically modified crops?
- Are genetically engineered foods safe, cheaper and more nutritious?

The media dialogues thus revolved around three major issues:

- Establishing suitable regulatory mechanisms to control the global trade of agri-biotechnology products;
- Ensuring that the potential risks to human health and the environment derived from using agri-biotechnology products are duly assessed and managed; and
- Increasing public awareness and acceptance of agri-biotechnology products.

The Biotechnology Information Center (BIC) in the Philippines has recommended basic messages for the media, opinion leaders, government and the public. These include:

- The safety of foods developed through biotechnology is assured through rigorous testing that meets rigorous international standards.
- Biotechnology can help make farmers be more competitive in the world agricultural market, and as a result will help the Philippines to be less dependent upon foreign imports.
- Biotechnology will be one additional tool that Filipino farmers can choose to make it easier for them to grow healthy crops with good yields.

A useful tool to help prioritize messages is the use of a message map. Dr. Vincent Covello of the Center for Risk Communication (2005 and 2007), defines it as a tool for organizing information in a transparent manner, thereby promoting open dialogue. It is a roadmap for displaying detailed, hierarchically organized responses to anticipated questions or concerns. Effective messaging involves the following steps:

- Identify stakeholders – interested or affected parties – for a selected issue of high concern.
- Identify a complete list of stakeholder questions and concerns. This list can be generated through research, including media content analysis, reviews of historical documents, interviews with issue experts, focus groups, and surveys.
- Analyze the questions to identify common sets of underlying concerns from the perspective of the intended receiver.
- Develop three key messages in response to the generated list of stakeholder concerns and specific questions. These messages must be brief, clear, and positive.
- Develop supporting facts and proofs for each key message. Proof points can be third party validation, use of statistics, and quoting a scientific study.

Using these steps, ISAAA's *Afri*Center developed message maps to present facts and figures on a particular subject in a format that facilitates quick reading and comprehension. These message maps (Figures 3 and 4) target parliamentarians and high level policy-makers with the aim of contributing to a better understanding of the various concerns related to biotechnology and biosafety in Kenya. The maps were distributed to all sitting members of Parliament to equip and prepare them to adequately discuss the Biosafety Bill from an informed perspective (Africa: Program Activity Review, 2007).

Once key messages are clear and concise, it is now possible to decide on communication approaches and strategies to use.

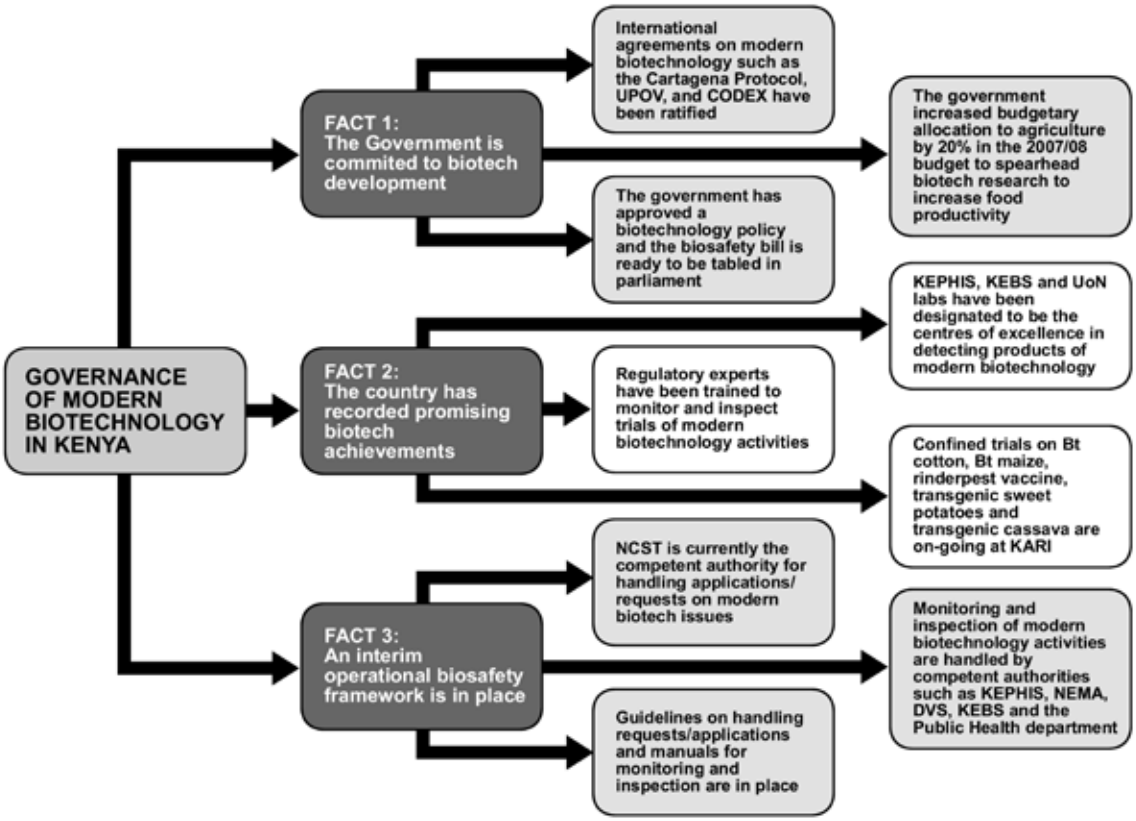


Figure 3. *Message map on governance of modern biotechnology in Kenya.*
Acronyms: UPOV- The International Union for the Protection of New Varieties of Plants; NCST- National Council for Science and Technology;KEPHIS- Kenya Plant Health Inspectorate Service, KEBS – Kenya Bureau of Standards, UoN- University of Nairobi, NEMA- National Environment Management Authority ;KARI – Kenya Agricultural Research Institute, DVS – Directorate of Veterinary Services

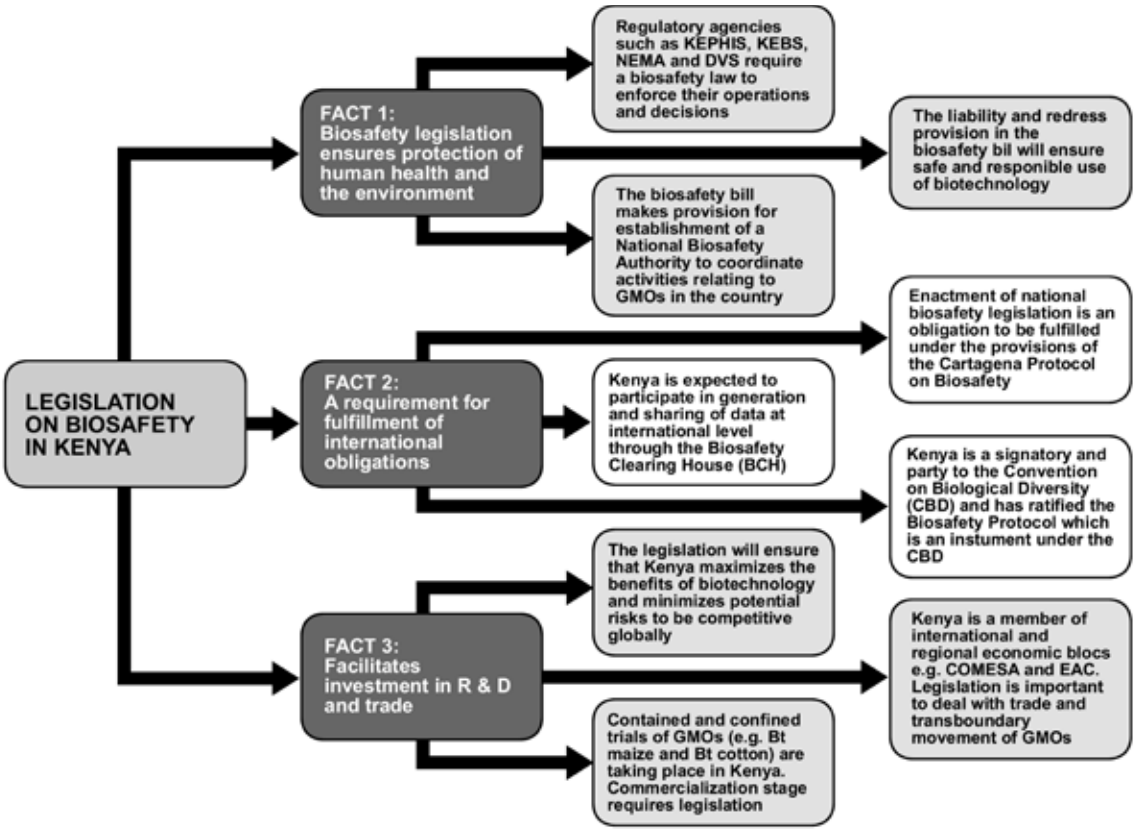


Figure 4. *Message map on biosafety legislation in Kenya.*
Acronyms: COMESA - Common Market for Eastern and Southern Africa; EAC – East African Community

VIII Developing Communication Approaches and Strategies

A strategic and complementary combination of interpersonal communication and different mass media modalities is recommended for effective science communication projects. Interpersonal communication is needed to achieve acceptance and use of technology while mass media help promote awareness, knowledge and understanding. The choice of and combination of communication strategies is determined by specific information requirements and needs. The following are examples of approaches and strategies used by the Global Knowledge Center on Crop Biotechnology (KC) and its information network of Biotechnology Information Centers (BICs):

Interpersonal Communication

Despite advances in communication techniques, face-to-face interaction remains to be the most popular choice of communication in developing countries. Personal interfaces allow people to interact in close proximity, use sensory channels to relay messages, and receive immediate feedback. Building networks and enhancing partnerships, or interacting with various stakeholders is essential to get information across, obtain immediate feedback, and correct/modify understanding of messages. Seminars, conferences, roundtable discussions, and workshops are some venues for interaction for specific audiences and desired impact. The content and duration as well as frequency are determined by the specific objectives to be addressed, and are affected by such concerns as budget constraints, logistical limitations and stakeholder interests.

Networking. A crucial role is establishing networks and partnerships with various stakeholders in both the public and private sectors. It can be among and between universities or academic institutions, the government sector, industry, and civil society groups such as those representing consumers and producers. Forging contacts enable organizations to share resources and experiences, avoid unnecessary duplication, and gain leverage by spreading the responsibility and accountability around. Participating in activities with like-minded organizations and those perceived highly on the credibility ladder is advantageous for

the success of science communication projects. It is also important to scan the local biotech environment, monitor media reporting, identify key institutions and people, and sustain relationships.

As the BICs assume a more prominent role in the biotech environment, they can take an important role in national policy and related activities. The BIC in Indonesia helped to draft and edit the guidelines on laboratory and field trial implementation of biotech research and development prepared by Indonesia's Ministry of Agriculture. It likewise drafted and provided information for country reports on biosafety for the Ministry of Environment. Thailand BIC was requested to moderate a discussion on policy on research and development (R&D) of biotech crops, and assisted in the drafting of the biosafety law with the Ministry of Natural Resources. It also held meetings with the Department of Agriculture and other institutions to discuss the biosafety framework, biotech promotion, and public-private partnerships. Bangladesh BIC helped to formulate a biosafety clearing house for the Ministry of Environment and Forests.

Seminars and workshops on biotechnology principles and applications are opportunities to update stakeholders on the latest trends as well as issues and concerns. These programs contribute to creating an enabling environment to support, for example, regulatory approval and eventual commercialization of biotech crops and food. Technical lectures and field trips to actual biotech fields or laboratory experiments enable stakeholders to integrate theoretical with practical learnings. The basic communication approach is the 'seeing is believing' technique. Based on the workshop objectives, specific stakeholders can share experiences, i.e. farmers on using certain technologies, or representatives from both public and private sectors doing R&D on biotech crops.

Heads of BICs are often invited to be resource persons in seminars and workshops organized by government and private agencies. Topics aside from BIC program are basic biotechnology, the status of country biotechnology initiatives, biosafety issues, communicating biotechnology, and global review of biotech crops.

Seminars. A half or one day seminar can be conducted for various stakeholders. Malaysia for example, organizes career talks for students and parents, co-sponsors discussions on genetic engineering in agriculture and biotechnology with organizations such as the Malaysian Agriculture Research and Development Institute, and the Ministry of Education. Egypt conducted a biotechnology and biosafety seminar for members of Parliament with the intent of familiarizing them with the technology and its issues.

Workshops. Different workshops can be designed to meet the specific needs of stakeholders. The following are examples of workshops developed for particular audiences:

Media. Communication practitioners and or government information officers and extension people are invited to a 1-2 day workshop to familiarize them with crop biotechnology initiatives, and updates on the local R & D scene. Learning strategies include lectures, laboratory exercises, video presentations, and a tour of laboratory and greenhouse experiments as well as farmers' fields. An educational game called K-Quest was developed by ISAAA and the Philippine BIC for use in workshops. Inspired by the children's games of Snakes and Ladders and Monopoly, the board game uses the concept of play to show the process that a biotech crop undergoes from the laboratory to farmers' fields, particularly the regulatory process.

It was also modified as a computer-based game for instant biotech quiz contests. An interactive version of the board game is currently being conceptualized so that it can be used as a teaching tool by other BICs.

BICs in India, Bangladesh, and Africa collaborated with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) to conduct series of media workshops in their respective countries either in English or in the local languages. Resource persons were biotechnology and communication experts from international, regional and national research institutes. A multi-media training kit developed by UNESCO was also tested. The experiences of these workshops inspired the development of a sourcebook on agri-biotech reporting (Navarro et al., 2006). The book, which distills the practical advice and guidelines for science communicators and journalists, is available also on the ISAAA website. A French version of the book for Francophone African journalists is also available in hard copy and online mode.

MABIC was able to invite two Australian science communication experts to spearhead a workshop on communicating biotechnology with media based in Sabah, Malaysia. The media and scientists had the opportunity to learn from each other in terms of expectations, work ethics, and a general understanding of how each stakeholder "works."

For BICs that do not have biotech crops, either commercially or in field trials, visits to laboratories or contained trials supplement the lectures. In other cases, media practitioners from one country visit countries such as South Africa, China, and India where biotech crops such as Bt cotton are being grown on commercial scale.

Scientists/Decision-Makers. Risk communication workshops equip participants with communication skills to enable them to respond proactively to high concern, controversial situations. A critical task is to be able to develop key messages that are believable, convincing, clear, concise, and positive. The intent is to

develop and identify communicators who would be able to assist in public awareness work. The workshop uses a combination of lectures, analysis of case studies, and mock media interviews that are often videoed and shown to participants to analyze and derive learnings from. Participants react to letters sent to editors or columnists of newspapers who feature a negative write-up about biotechnology, engage in simulated television interviews, and analyze articles written by scientists for newspapers. The first day is usually devoted to lectures and discussions about biotechnology and issues surrounding it. The second day is a skills course on communication, visits to a biotech laboratory or greenhouse facility, and a field trip.

Participants who attend risk communication workshops gain both technical information and appropriate communication skills.They are expected to articulate and craft message strategies that will enhance trust and minimize conflicts over controversial issues.

Other Stakeholders. Other venues for interaction are farmers' or other stakeholder workshops or study visits which aim to, among others, increase their awareness of the challenges facing agricultural biotechnology as well as its benefits; explore effective communication techniques; and facilitate sharing of experiences in using modern biotechnology. The workshop involves an introductory discussion of biotechnology concepts and issues, sharing of experiences, field tours, and planning for the next set of activities.

Farmers from Indonesia, Vietnam, Thailand, India, and Malaysia met with colleagues in the Philippines to share experiences and to talk to farmers planting Bt corn, and researchers working on biotech papaya. This farmers' workshop gave rise to the creation of the Asian Farmers Regional Network. The workshop was replicated in West Africa for farmers in Mali, Burkina Faso, Togo, and Senegal through visits to the Bt cotton trials in Burkina Faso.

A series of risk management and social marketing training-workshops were conducted in the Philippines to prepare for the multi-location field trials of Papaya Ringspot Virus (PRSV)-resistant papaya and Fruit and Shoot Borer- resistant eggplant. These were intended to provide stakeholders, institutional biosafety committee members, and potential product champions particularly in areas where the multi-location field trials will be conducted, with the needed skills in risk communication, information dissemination and outreach.

Regional Conferences. Several BICs can organize and implement a regional conference. One case in point is a workshop on the "Development of agricultural biotechnology in Islamic countries: Sharing experiences on issues and challenges" held in Cairo, Egypt, and another in Islamabad, Pakistan on "Innovative aspects of biotech and its better awareness and dissemination." Both were spearheaded by the BICs from Malaysia, Pakistan, Egypt, Indonesia, and Bangladesh. Participants from the Islamic community in Asia and Africa converged to discuss biotechnology interventions and the role of Islam in its development. The concerned BICs helped prepare a proposal which was submitted for funding and worked with a local institution to implement the said activity.

Global Launch. An important yearly activity of the BICs is to contribute to the annual global launch of the Annual Review on the Global Status of Commercialized Biotech/GM Crops authored by ISAAA's chair Dr. Clive James. ISAAA with the Center in India and the Philippine BIC facilitated and

managed the international launch of the Annual Review and organized the international call conference in 2007 and 2008, respectively. The international call conference organized through telephone conference and webcast provides an opportunity to present the Review to international media personnel representing key print, news services, and electronic media such as the New York Times, Washington Post, Times of India, Bloomberg, Dow Jones, Reuters, and Wall Street Journal. A series of country launches are also held in tandem with a seminar or press conference/media briefing. Where possible, Dr. James makes the presentation with a local expert providing an overview of the status of biotech in a specific country. Otherwise, a public seminar and or media briefing is held with key experts. BICs translate the Executive Summary and press release for distribution to stakeholders, organize the seminar briefings, and answer inquiries either through newspaper, radio or television interviews.

The annual global launch has been a very successful strategy to increase awareness of global biotech developments. The 2007 Review generated over 750 million (up from 550 million) impressions (estimated number of people reached by the articles). About 1125 print stories written in 31 languages in 46 countries were produced from the 2006 launch. In addition, interviews or features on the same topic were broadcasted on national television.

Tri-media Interviews. As the BIC gains visibility in the biotech arena, BIC representatives get invited as a resource person or guest in radio and television or interviewed in newspapers and magazines. Topics include the BIC and its role in national development, technological updates, biotech issues and concerns, global status of biotech crops, and announcements about upcoming activities. In like manner, BICs can initiate press conferences, media dialogues or interviews, or even invite media to visit relevant laboratories, institutions, and or crop fields. The BIC in Egypt often gives media interviews focusing on agricultural biotechnology and biosafety concerns, as well the country's experiences on biotech crops. As a result of these interviews, articles are featured in national papers such as Al Taawen and AlAhram and magazines like Cotton Outlook. In the case of Indonesia, Warta Ekonomi, Pakuan Raya, Radar Bogor, and Radio Republik Indonesia Bogor wrote articles or radio materials based on interviews with the BIC head.

Network Meeting. The KC holds an annual planning meeting with its BICs to update each other on communication/ information dissemination activities and to plan for the year ahead. Meetings have been held in Bangkok, Kuala Lumpur, Manila, Bogor, and Singapore. Each BIC gets to present a general status of biotechnology in their respective countries and then segues to accomplishments for the year in terms of gaining greater awareness and understanding of the technology. The meeting is also an opportunity for invited resource persons or network staff to share communication strategies such as website enhancement, writing for newspapers, resource generation, and proposal preparation. Visits to specific institutes of interest are made such as the Science Centrum in Singapore, Malaysian Agricultural Research and Development Institute, PRSV papaya contained field trials in Kasetsart University, Thailand, and the University of the Philippines Los Baños Institute of Plant Breeding. One-on-one interactions enable BICs and the KC staff to discuss progress made, problems faced, and expected deliverables.

Exchange visits are done among BIC staff to benefit from each others' expertise. Staff also get to attend workshops and related activities of BICs to learn techniques and network with like organizations.

Website Development

A website is a primary information source which can be accessed by many people at one time as long as they are connected to the Internet. It is a venue for information updates, sharing of information and knowledge, and allows for interactive communication. It often provides the first impression of what the institute is all about. The ISAAA website contains information on its centers, institutional programs, and resources (http://www.isaaa.org). The KC has a website imbedded in the ISAAA website (http://www.isaaa.org/kc) which focuses on its information centers, information resources, e-newsletters, and directory/ links. Since a survey confirms that people visit the site to download materials, there has been a deliberate effort to provide online information resources.

The ISAAA website is designed to be user-friendly. It is organized to allow ease of navigation across sections, enables users to search sites, has an RSS page for its e-newsletter which allows immediate notification of new items, and categorizes information for easy access and retrieval of information. Many of the ISAAA publications including archived materials are available for downloading in various formats, video series can be viewed by streaming directly on screen, while flash papers (PowerPoint presentations) can be seen and used directly from the site. On-line ordering of publications is likewise possible.

BICs set up their individual websites, either independently or embedded in the host's website. The websites of BICs in Malaysia and Indonesia for example, are a sub-set of their host's website. A typical website contains information about the BIC, local news on crop biotechnology, documents and translations of BIC and KC publications, and issue backgrounders on biotechnology either in English or the national language. Thailand's website has an e-survey to determine readers perception of various biotech issues.

The websites, while focusing on specific country concerns, are visited by people from other countries. One example is that of Egypt where top visitors to the site include those from Saudi Arabia, United Arab Emirates, Jordan, Lebanon, and Syria. Egypt's website is the only online Arabic resource on biotechnology.

E-Newsletter

The KC produces a weekly e-newsletter called the Crop Biotech Update or CBU. The CBU is a synthesis of developments in crop biotechnology worldwide with implications for developing countries. Articles are sourced from primary journals, contacts, websites of credible institutions, documents, published articles, and news from the BICs. They are categorized according to news of origin or context: Global, Africa, Americas, Asia and the Pacific, and Europe; research, announcements of biotech-related events, and document reminders.

In addition, the Biofuels Supplement is produced every two weeks devoted exclusively to developments in that field as well as announcements on events and other related issues. It basically follows the CBU format but articles are classified as news and trends; energy crops and feedstocks for biofuels program; biofuels processing; and biofuels policy and economics. Both newsletters are sent as an email to a subscriber's list that number over 500,000 from 200 countries as of early 2008. The list excludes subscribers of other listservs that pick

up news from the Update. The news (in full or selected articles) is translated into 11 other languages (Arabic, Bahasa Indonesia, Bangla, Chinese, French, Italian, Japanese, Portuguese, Spanish, Thai, and Vietnamese). It is also republished by third party institutions in their respective websites such as government agencies, public sector agencies, and private companies. One case is the Ministry of Science and Technology in Kenya.

BICs can either send a complete news article or provide basic details that a writer can transform into an article (answers to the questions who, what, where, and how). News articles submitted to the CBU are two to three-paragraph summaries with a hyperlink to the original publication, or an email contact to the main author or correspondent. An example of a BIC-generated article is:

India's DBT Posts New Guidelines for GM Crops

India's Department of Biotechnology (DBT) has formulated a set of new policy instruments in response to the increase in the number of field trials being conducted for several crops with new genes/ events by public and private sector institutions. The DBT initiated an exercise to develop guidelines for conducting field trials of regulated and confined field trials of genetically engineered plants in India. The existing DBT's revised guidelines for research in transgenic plants and guidelines for toxicity and allergenicity evaluation of transgenic seeds, plants and plant parts was introduced way back in August 1998.

The new draft policy instruments include: 1). Draft Guidelines for the conduct of confined field trials of regulated, genetically engineered plants in India, 2). Draft Standard Operating Protocols (SOPs) and Recording Formats for confined field trials, and 3). Draft Protocols for assessment of toxicity and allergenicity in transgenic crops. The draft policy instruments are available for public comments at the Indian GMO Research Information System (IGMORIS) website at http://www.igmoris.nic.in/.

Send comments and suggestions to Dr KK Tripathi, Advisor, Department of Biotechnology at: kkt@dbt.nic.in. For more information about biotech in India contact Bhagirath Choudhary of the International Service for the Acquisition of Agri-biotech Applications (ISAAA) South Asia Center at b.choudhary@isaaa.org.

On the other hand, articles that do not have a 'global' angle can be used in the section "From the BICs." Here, articles about activities such as workshops and seminars are documented.

The Philippine BIC has an e-group news service that compiles news on biotechnology published by national papers and sends it out to its mailing list. It has clickable icons that provide links to various sections and a "What's up" frame showing three sections: news, information gallery, and discussion group.

Other e-strategies are **email distribution lists and discussion groups** which are effective in discussing a topic in real time through the Internet. A network of journalists and scientists, that participated in media workshops organized by ICRISAT and ISAAA, was set-up as a discussion group to get updates and share opinions about the technology. The members of the network are also recipients of the CBU. Messages and opinions are posted on the site which allows virtual interaction. BICs in Bangladesh and Malaysia use mail groups to send their e-newsletters.

Mailing list database. People who are sent e-newsletters, documents and other publications are listed in a database of subscribers or recipients. A central subscriber database management system for CBU subscribers at the KC enables the listing and categorization of recipients based on these variables: email address, country, organization, and designation. As per a formula provided by Dr. Clive James, ISAAA's chair, the BICs are estimated to have a quota of 200 subscriber-names for every 1 million population. Hence, in the case of Indonesia which has a population of 234 million, it should aim for 46,800 names in the central subscriber list. The BICs also maintain a database of both electronic and non-electronic recipients for local publications and hard copies. BICs are encouraged to update their mailing list at least once a month to enable new names to be included, information to be verified, and errors checked.

Publications and translations

Various publications from flyers, brochures, fact sheets, monographs, modules to Briefs facilitate understanding of concepts and procedures. It is

important to consider educational level, language, and content when developing publications. The KC caters to the information needs of different clients by developing various printed materials. These materials can either be adapted and developed into other materials, or directly translated into languages of specific countries where BICs are located. The BICs also develop their own materials, either in English or the language of choice.

The most popular KC publications are Briefs and Pocket Ks. Briefs are series of publications that address and analyze specific topics such as transgenic technology, Bt maize and Bt cotton. Of these, the Annual Brief, a review of the global status of commercialized biotech/GM crops is regarded as the most authoritative single source of information and the most cited reference on the subject. It provides an in-depth analysis of global developments pertaining to biotech crops, distribution of biotech crops in specified countries, global adoption of the major crops, and specifically on the status of regulatory approvals. Complementing this publication is an illustrated Executive Summary of the global review which recapitulates and highlights key messages of the full Brief.

Pocket Ks (knowledge) are a series of packaged information on crop biotechnology products and related issues. Topics include questions and answers on crop biotechnology, plant products of biotechnology, documented benefits of GM crops, contribution of GM technology to livestock sector, biofuels, biotech plants for bioremediation, biopharming, biotechnology for the development of drought tolerant crops, biotechnology and biofortification, and ethics and agricultural biotechnology. These are regularly updated and or revised to reflect new information.

All publications including institutional brochures of ISAAA and the KC, and monographs of research studies are available on ISAAA's website. Contributions are submitted and published as either a chapter in an international book, an article in a peer-reviewed journal, or proceedings of a workshop.

BICs produce materials that are direct translations of ISAAA publications like the Annual Review executive summary, and Pocket Ks. India has eight language variations of these publications. The BIC in Vietnam provided documents which it translated into Vietnamese to the Ministry of Agriculture and Rural Development. These documents such as a write-up on Bt corn in the Philippines and its regulatory requirements were used as references for discussion of Vietnam's biosafety guidelines.

Other BICs develop their own printed newsletters such as Pakistan's Arisen (both in English and Urdu), Thailand's BBIC Newsletter (Thai), and Egypt's Roayaa (Arabic), or are made available electronically as in the case of Malaysia's BICAlert. Vietnam produced a handbook for researchers on how to use the Internet for sourcing information on biotechnology. India developed a publication on crop biotech and biosafety, a document that contains a background on crop biotech, definition of genetic engineering, avenues

of crop biotech, development of transgenic crops, and regulatory framework and safety aspects. ECABIC wrote a banana policy brief to orient Kenyan policy-makers on the need for a better policy environment to boost performance of the banana sector, and a biotechnology handbook for policy makers.

News Releases. The BIC is a major source of news about biotech developments in a country. News could be a breakthrough or major activity, and policy or institutional development that have implications for biotechnology research and development. News in Indian newspapers such as the Hindu, Times of India, Business Standard, and Financial Express quote ISAAA in articles by-lined by journalists. This is the same case in Pakistan where press releases are written for the Associated Press, Pakistan Observer, Business Recorder Islamabad, the Nation, and News International. Bangladesh supplies articles for the Daily Star, Jaijai Din, Naya Diganta, Ittefaq, and Krishi Biplap.

BICs also send information or articles to the CBU and is oftentimes the only news coming from a specific country as in the case of Vietnam, Thailand, or Indonesia where original articles are in the local language.

Video Production

A growing niche for the KC is the documentation of information, practices, and events related to the use of certain biotechnologies in developing countries. This involves documenting story patterns on crop biotechnology experiences from the perspectives of different stakeholders so that such learnings can be shared with other people. Videos can be used to introduce a topic during a workshop to stimulate interest, reflect on issues, and generate discussion.

The production is commissioned with either a private video company or a government television station. However, brainstorming on the script, style of presentation, audio/visual components, persons to interview, points of interest or emphasis, and related aspects are discussed by the KC with the production crew.

Years of country experiences were captured in 15-18 minute videos, notably those related to the adoption of Bt corn in the Philippines, tissue culture banana in Kenya and Tanzania, clonal forestry in East Africa, Bt cotton in India and China, and development of biotech papaya in Southeast Asia. These series of videos are used in instruction, and as springboard for discussion in workshops and seminars. Translations into local languages allow greater reach of these materials. West Africa produced a 20-minute documentary in French regarding highlights of a media workshop and visits to Bt cotton fields. This video is being used in training programs for Francophone African audiences. The Center in India spearheaded the production of the Bt cotton video and has been translated into eight other local languages. All the videos are available in video streams on the ISAAA website.

Exhibits

Institutional or topic-based panel exhibits are developed for public viewing during workshops and conferences. Exhibits enable concepts and key highlights to be presented visually using minimal text and more of visuals. India participates in annual events like Bangalore Bio where an exhibit stall is set-up and a mini-quiz competition on crop biotechnology is conducted. This allows a glimpse into the knowledge-level of the viewers from different sectors like students, farmers, government officials, and industry representatives. The Philippines participates in the country's yearly Biotech Week with an exhibit that attracts

a sizeable number of stakeholders. In Kenya, activities are highlighted through participation in such events as the weeklong Nairobi International Trade Fair and various regional agricultural exhibitions.

Other Materials/Strategies

CD ROMs and PowerPoint presentations are developed to aid stakeholders in accessing information for instruction, briefing, and outreach activities. CD ROMs can contain publications developed by the KC or BICs, workshop PowerPoint presentations, and relevant documents and materials. Modules on such topics as the global status of commercialized GM/biotech crops, an introduction to GM technology, and food safety issues and concerns, can also be produced for mentors, and other interest groups in PowerPoint format.

Radio is an underutilized communication medium that can reach a large number of people at a relatively low cost. *Afri*Center produces radio and television plugs in the local language. Topics include introduction to modern agriculture, Bt cotton as a flagship crop in Burkina Faso and Mali, socio-economic impacts of Bt cotton, and perspectives or trends in modern biotechnology. Each of the topics identify key messages to discuss by focusing on the most important concerns. For example, a plug on the introduction to modern agriculture emphasizes the availability of new technologies such as biotechnology, and the need to use them safely and responsibly. Potential use of radio is worth exploring particularly educational plugs and documentary programs that provide testimonials of technology users.

Bangladesh and Vietnam hold writing contests on biotechnology that attract article submissions from government employees to students. Winners get prizes and articles are published in a national paper. Aside from gauging knowledge level, the contests reflect audience interest and attitudes toward the topic.

There are many other materials and strategies that can be used in communicating biotechnology. Communicators are limited only by their imagination and willingness to think out-of-the-box.

How have the BICs communicated concepts and issues on biotech to their audiences? The next few pages give examples of the diversity of activities and work in progress being carried out by some of the BICs.

BICs *in Action*

Africa BICs

• **Margaret Karembu & Daniel Otunge**

In Africa, ISAAA facilitates three Biotechnology Information Centers (BICs), one in Egypt (EBIC) for the Arab-speaking Africa hosted by the Agricultural Genetic Engineering Research Institute (AGERI); one in Mali (Mali-BIC) for Francophone West Africa housed by the *l'Institut d'Economie Rurale*,(IER) in Bamako, and the East and Central Africa Biotechnology Information Center (ECABIC) which was initially a collaborative initiative with the African Biotechnology Stakeholders Forum (ABSF) but currently hosted by the ISAAA Africa office in Kenya. In carrying out the outreach program, the Africa BICs liaise with other existing like-programs and institutions within respective sub-regions to avoid duplication and ensure synergy of effort. Two such arrangements include a joint venture with the AfricaBio in South Africa and in Burkina Faso with the Burkina Biotech Association (BBA).

Specific operational methodologies include: stakeholders' sensitization workshops; scientific live-shows; seeing-is-believing travelling workshops; agricultural exhibitions; outreach to relevant parliamentary committees and policy-makers; and expanding capacities for media reporting, science communication, and biosafety regulatory systems. A cross-cutting activity is simplifying scientific materials through repackaging and translating into local languages to suit Africa's diverse audience.

ECABIC

Since its inception in 2001, East and Central Africa BIC (ECABIC), working with local and sub-regional partners has strategically executed project activities within its mandate through a number of interventions including communication and policy outreach, capacity building for science communicators, regulators and the media, and, knowledge-sharing through fostering exchange of information and networking. Notable achievements include: facilitating the drafting of the Kenya Biotechnology Policy and Biosafety Bill; enhancing parliamentarians' understanding of biotech issues through seeing-is-believing travelling workshops, hands-on training of several journalists with increased balanced media coverage; synthesizing, packaging and disseminating stakeholder-specific information; and demystifying biotechnology through scientific life-show demonstrations and exhibitions. As a result of the outreach program, there has been increased demand for biotech-derived products in eastern Africa such as tissue culture banana and fast growing trees, as well as better understanding of the relevance of on-going confined field trials of Bt cotton and maize respectively.

In 2007, the Center provided a successful coordinative role to the Biosafety Consortium, a stakeholder-driven process of catalyzing enactment of the Kenya Biosafety Bill which went through a highly informed debate in parliament but was time-barred when parliament was dissolved before final voting. Another lead role has been in the drafting of a National Awareness Creation Strategy (2007-2012) under the Kenya BioAware initiative of the Ministry of Agriculture. The strategy provides a framework within which

specific actions will be undertaken to promote awareness, provide a knowledge base for decision-making and hasten development of biotechnology in Kenya. A key milestone in 2006 was the launching of the Open Forum on Agricultural Biotechnology (OFAB), a joint collaborative venture between the Center and the African Agricultural Technology Foundation (AATF). OFAB addresses the need for strengthening inter-institutional networking and sharing of credible, sound and factual biotechnology information in Kenya and the sub-Saharan region. In a span of one year, 10 luncheon fora were organized, providing an opportunity for a wide range of stakeholders to interact, share knowledge and experiences, make new contacts and explore new avenues of bringing the benefits of biotechnology and science and technology in general to agricultural development in Africa.

Production and dissemination of focused materials on biotechnology and biosafety is one of the core business areas of ECABIC. The materials are targeted at high level policy-makers, parliamentarians, regulators, consumers and the general public. These include the publication of policy briefs, Pocket Ks and message maps to contribute to a better understanding of the various concerns related to modern biotechnology and biosafety. These serve as quick references for parliamentarians and high-level policy-makers. Two Pocket Ks on "Highlights of Kenya National Biotechnology Development Policy" and "Contribution of Agricultural Biotechnology in Alleviation of Poverty and Hunger," and a policy brief summarizing contents of the Biosafety Bill were published and appreciated by a wide range of stakeholders who could not grasp the technical jargon in the actual policy and draft Bill. The Center mobilized support for the Biosafety Bill by reaching out to relevant parliamentary committees and building a strong team of champions to ably defend the Biosafety Bill from a point of knowledge. This entailed confidence-building through increased interactions between parliamentarians, local experts, and high level policy-makers to enhance their understanding of key issues covered by the Bill.

Exposure for parliamentarians and policy-makers is fundamental in changing mindsets and enhancing informed decision-making. The Center, in collaboration with the Kenya Agricultural Research Institute (KARI), AfricaBio and the African Biotechnology Stakeholders Forum (ABSF) conducted several 'seeing-is-believing tours' for parliamentarians, policy-makers, regulators, the media and other stakeholders. The tours are meant to expose, create awareness, and educate relevant parliamentarians and other key stakeholders on the institutional, technical and human capacities available in the region for responsible and safe research, development and commercialization of biotech crops.

ECABIC is recognized for building the capacity of the media in science communication and scientists on media relations to bridge the knowledge gap between scientists and the public. Scientists and journalists are trained on effective communication and accurate reporting of issues related to biotechnology developments and biosafety on a regular basis.

Mali BIC

In Francophone West Africa, ISAAA has worked with several partners on various biotech outreach initiatives. Since 2003, a biotechnology information center was established in l'Institut d'Economie Rurale (IER) in Mali to distribute science-based information on GM crops. The center, together with local collaborators implemented a communication strategy during the 2005 Ministerial Conference on Agricultural Biotechnology held in Bamako. A major outcome was the formation of RECOAB - the Réseau des communicateurs Ouest-africains en Biotechnologie Agricole, a network of journalists reporting on biotechnology. The network provides a forum

through which journalists can share sources of information, discuss the credibility of sources and receive feedback on their work from their peers. RECOAB serves as a point of contact for organizations wishing to communicate with journalists and the public on biotechnology in the sub-region. Member journalists have developed competencies in the area of biotechnology reporting and gained credibility in the sub-region on covering the subject. They have also been able to cultivate relationships with representatives from the government, research institutes, universities and non-government organizations (e.g. FARA, INERA, IER, ECOWAS). Country coordinators for Burkina Faso, Benin, Cote d'Voire, Chad, Mali, Niger, and Senegal have been identified. A major development was the start-up of a RECOAB coalition in Anglophone West Africa with active members from Ghana, The Gambia, and Nigeria.

Other key achievements in the sub-region include capacity building for spokespersons in Mali through the Consultative Group on Biotechnology and in Burkina with BBA where scientists and government technocrats have been trained on basic principles of risk communication and additional tools to respond to common questions about biotechnology. Exposure tours for different stakeholders in the sub-region including farmers, parliamentarians and the media to the Bt cotton trials in Burkina Faso has helped build the confidence on the technology among these teams and increased acceptance.

A key milestone is the production of a monthly biotech bulletin with the Burkina

Biotech Association (BBA). Biotech ECHO is the first of its kind in the sub-region and is edited by Professor Alassane Sere, a former Minister (Animal Resources) in the Burkina cabinet and also President of BBA. The bulletin features both news and feature articles based on local activities and less than 25 percent of content is of international origin. The Newsletter has received very good reception from recipients and rated as one of the most credible source of easy-to-read biotech information in French for the region. Even the media depends on it for story leads.

Egypt BIC
• Ismail Abdel Hamid

Egypt Biotechnology Information Center (EBIC) is a not-for-profit center, established jointly between the Egyptian Ministry of Agriculture and Land Reclamation, and ISAAA. EBIC is located at the Agricultural Genetic Engineering Research Institute (AGERI), Agricultural Research Center (ARC).

EBIC's mission is to inform and promote public awareness of biotechnology. It works as a link between scientists and the public by simplifying scientific information for various audience levels. It also clarifies both benefits and potential risks through open and transparent discussion. EBIC plays an important role by gathering stakeholders in local, regional, and international scientific discussion and activities. Such workshops enable a variety of ideas, scientific perspectives and strategic points to be explored and discussed. A case in point is an inter-Islamic country workshop done through the collaborative efforts of ISAAA, the Islamic Educational, Scientific and

Cultural Organization (ISESCO), Organization of the Islamic Conference (OIC) bank, and EBIC to discuss challenges of biotechnology. Media specialists participated in a seeing-is-believing program organized by EBIC which enabled them to visit South Africa and explore the importance of biotech crops. Another visit to Pakistan was facilitated where media specialists from different Islamic countries discussed the possibilities for commercialized biotech crops.

EBIC has an Arabic newsletter called Roayaa that covers issues about biotechnology and its applications to agriculture. It also started and continues to be the first Arabic website to explore the most updated information in agricultural biotechnology.

ISAAA South Asia Office

• Bhagirath Choudhary

ISAAA's principal office in India established in August 2004 is co-hosted by the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) in its premises at New Delhi, India.

In a very short period of over three years, the ISAAA program in India has successfully built and very effectively spearheaded knowledge sharing and biotech capacity building programs for diverse stakeholders ranging from policy-makers, scientists, regulators, journalists to farmers. It has effectively engaged print and electronic media practitioners in a constructive dialogue and received enormous media mileage on new cutting edge crop technology, that has potential to directly benefit small and marginal farmers in India. Extensive outreach media programs in different languages resulted in getting an unprecedented amount of positive media exposure and coverage for crop biotechnology through various activities including media workshops, interviews, articles and regular briefings. In order to keep them up-to-date on biotech developments, ISAAA along with ICRISAT runs a discussion group on agri-biotechnology, linking scientists, journalists and other stakeholders. More than 100 journalists participate in the discussion group from around 10 countries in South Asia and Africa. ISAAA also regularly supplies latest information on crop biotech and biofuels through its weekly e-news services such as Crop Biotech Update and Biofuels Supplement.

ISAAA South Asia Office has successfully engaged in extensive outreach work program with many stakeholders from elected policy-makers, government officials, scientists, extension workers and farmers at both the national and state levels. It has also produced biotech documentaries, developed a range of publications, and organized programs in different local languages to provide easy-to-comprehend and credible information to all stakeholders.

All outreach programs are designed and executed in collaboration with public sector institutions and not-for-profit organizations. Some of

the collaborators in India include ICRISAT, Indian Agricultural Research Institute (IARI), Indian Society for Cotton Improvement (ISCI), Biotech Consortium of Indian Ltd (BCIL), Asian Media Information and Communication Center (AMIC), Karnataka Media Academy (KMA), Tamil Nadu Agricultural University (TNAU), Delhi University, Directorate of Rice Research (DRR), Punjab State Council for Science and Technology and Ministry of Environment and Forest (MOEF). In a short time span, the impact of its knowledge sharing and biotech outreach activities in India is far-reaching and visible.

Keeping in view the importance of ISAAA activities, it has been increasingly receiving funding and institutional support from the local public and private sector organizations in India including the Ministry of Environment and Forest, Barwale Foundation, JK Agri-Genetics and Rasi Seeds. The following major achievements in 2007 deserve noting:

- The International launch on January 18, 2007 followed by a press conference for print and electronic media in New Delhi. These events generated more than 150 news articles and generated 107 million impressions alone in India as compared to around 1100 articles and 550 million impressions globally for 2007;
- ISAAA India office organized the ISAAA Board Meeting, for the first time in India at New Delhi;
- ISAAA India office organized the ISAAA Board members visit to the Central Institute for Cotton Research (CICR) Regional Station in Sirsa, Haryana State and visits to Bt cotton farmers fields in Sirsa District of Haryana State, and to experimental fields of Hybrid rice at the Indian Agricultural Research Institute (IARI), New Delhi; and
- ISAAA India office facilitated the first technology transfer project – Papaya Ringspot Virus-Resistant (PRSV-R) Papaya technology from Monsanto to the Tamil Nadu Agricultural University (TNAU) Coimbatore.

The remarkable story of Bt cotton, the first commercial biotech crop introduced in 2002, goes along with the ISAAA's unprecedented program in India. Surprisingly, it is the fastest adopted crop technology in the recent history of Indian agriculture. ISAAA estimates that around 3.8 million small and marginal farmers have planted Bt cotton hybrids over 6.2 million hectares or about 66 percent of total cotton area of India in 2007.

Knowing Bt cotton has delivered multiple benefits to farmers, agriculture and ecology, a large number of biotech crop products are at various stages of development in India. Both public and private sector institutions are incorporating different and stacked biotech traits in vegetables and other food crops in order to provide most advanced biotechnology in the simplest form as seeds to farmers. These traits include insect resistance, virus and fungal resistance, effective weed control through herbicide tolerance, salinity and drought tolerance, yield improvement, nutritional enhancement and delayed ripening for increased shelf life. Keeping in view the potential of these products to increase agricultural productivity and environmental sustainability,

it is important that these products are made available to small and marginal farmers without hassle and unnecessary delay. More importantly, ISAAA's outreach and communication work across India will remain critical especially when Bt Brinjal (Eggplant) and Bt Rice are finally released in the not-too-distant future. Being the first biotech food crops to undergo public scrutiny, it will most certainly need effective parallel communication efforts to ensure public acceptance. ISAAA India office assumes a significant enabling role in ensuring early deployment of these potential technologies to Indian agriculture.

Therefore, ISAAA India office continues to implement its national level knowledge sharing and biotech outreach activities in alignment with the proposed State level activities. Besides publications and capacity building programs through media workshops and briefings, this includes continuously highlighting crop biotech developments in India in ISAAA's flagship annual review on the global status of commercialized biotech/GM crops commonly known as ISAAA Brief and through the Crop Biotech Update and Biofuels Supplement.

MABIC

• **Mahaletchumy Arujanan**

The Malaysian Biotechnology Information Centre (MABIC) is a registered not-for-profit organization with a non-government organization (NGO) status in Malaysia. MABIC is the first and only NGO that promotes biotechnology in Malaysia and enjoys excellent working relationship with ministries, government agencies, research institutes, universities, trade organizations, embassies and high commissions, media, industry and farmer organizations. As a well-recognized information center, MABIC strives to ensure that all its information and activities are scientifically sound. In order to uphold the scientific integrity, an advisory committee is in place to advice and review MABIC's activities and plans. The advisory committee is made of top scientists and stakeholders who are highly respected in their respective fields and represents the scientific community, industry, policy-makers, media, academe, and legal fraternity.

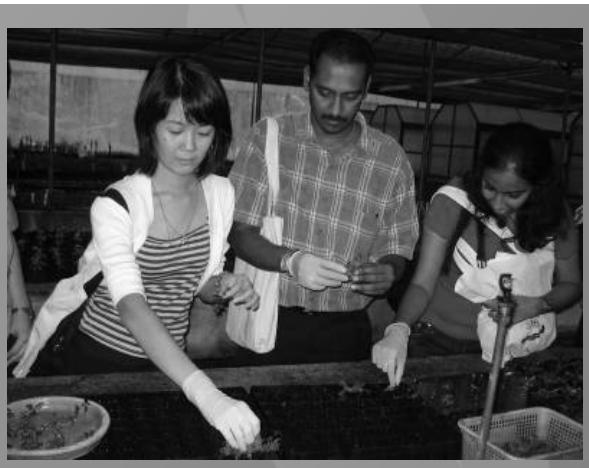
MABIC organizes an average of 12 events every year with an objective to create awareness on various issues that are pertinent to the growth of biotechnology in the country. Events are organized for scientists, students, policy-makers, members of the media, and religious authorities. MABIC has also been successful in initiating international events. Two such events were organized in Cairo, Egypt and Islamabad, Pakistan on "Development of Biotechnology in Islamic Countries" and "Journalists Exchange Programme: Reporting on Agricultural Biotechnology," respectively. Funds for these events were obtained from international organizations such as the Islamic Educational, Scientific and Cultural Organization (ISESCO) and Organization of Islamic Conference (OIC) Standing Committee on Scientific and Technological Cooperation (COMSTECH). These events were milestones for MABIC as it was able to reach out to audiences beyond Malaysian soil and gained recognition and facilitated the participation of Malaysian stakeholders in these events where sharing of experiences took place.

Another key objective achieved by MABIC in recent years was the ability to garner both in-kind and financial support from outside ISAAA to run its activities. Collaborators are often more than keen to support MABIC's activities due to its strength in sourcing for excellent speakers (both local and international), strong technical and scientific input, and the success in gaining publicity for the event. In return for these

contributions, MABIC enjoys the privileges of getting free venue and logistics support for the events it spearheads. In certain instances, MABIC receives a modest honorarium as a token of appreciation for its services. These funds are channeled back to MABIC's activities. Further to local support, MABIC has also managed to forge new working relationship with Australia Malaysia Institute (AMI) that has served as a donor for several MABIC activities.

Over the years, MABIC has managed to be the top biotechnology information portal with its website. Together with the website and the outreach programmes organized, MABIC has remained as the single most active organization in creating public awareness and addressing key issues in biotechnology to Malaysian stakeholders. Besides these activities, MABIC sits on several committees that advises the government on biotechnology and its executives get invited as speakers and resource persons.

As a balanced biosafety regulatory framework could be a rate-limiting factor in creating a conducive environment for research, commercialization and in attracting foreign investment, MABIC has taken a keen interest in educating



stakeholders in this area. Workshops and conferences were organized with international experts as resource persons. MABIC works closely with the Malaysian Biotechnology Corporation towards achieving this objective.

Another milestone project in the pipeline is the creation of a database which will enlist all biotechnology scientists in Malaysia with their profile and respective research area. This database will be the first of its kind in Malaysia which will enable stakeholders around the globe to search for collaborators and partners to undertake research activities and encourage sharing of experience and communication among scientists, industries and other interested parties.

PABIC

• Muhammad Iqbal Choudhary

The Pakistan Biotechnology Information Center (PABIC) has a strategic initiative to promote communication and knowledge about biotechnology in Pakistan. It aims to produce a better-informed citizenry who would be able to make informed decisions about aspects of biotechnology.

PABIC supports the establishment of an active network of science communicators of 27 institutes in Pakistan who gather and exchange experience and communication strategies with each other. Working groups are set up to draw up a catalogue of Best Practices, incorporating the success formulas for communication in the life-sciences especially in biotechnology-related research. The structure of this catalogue will be based on target groups and subject matter, and will provide information in a form that can be immediately used by members of the network.

The Internet platform of PABIC contains educational materials about biotechnology-related research and links for target groups, and categorized by level of knowledge. Most of the publications and educational materials provided by ISAAA (translated in Urdu version) can be downloaded from the website. In addition, it will also contain a large virtual library with illustrative materials that can be downloaded free of charge.

SEARCA-BIC (Philippines)

• **Sonny Tababa & Rochella Lapitan**

When the Southeast Asian Regional Center for Graduate Study and Research in Agriculture Biotechnology Information Center (SEARCA BIC) was established, the first two weeks were spent in knowing the environments that it would be operating in namely, SEARCA, ISAAA, and the biotech arena in the Philippines. We needed to know then where to situate BIC among the many agencies doing biotech R&D and outreach activities. It was important to know what tasks had to be done first and for whom. The consultation workshop with key stakeholder groups was held a month after we became operational. We started with the local contacts that we had developed and maintained over the years. The consultation workshop helped us chart directions, prioritize activities, and identify strategies to reach out to stakeholders.

Collaboration and networking were very important. In 2000, a lot of attention and controversy brewed over genetically modified crops especially with the planned first limited trial of Bt maize in Southern Philippines. We knew then that the media, researchers, communication officers, and the local government units were our immediate concerns. Important stakeholders like the policy-makers at the national level, academe, and private sector were to be reached out mainly by our key partners who were also doing biotech outreach activities. By working together with partners who have their own extensive networks, more public sector agencies were tapped to support the biotech information campaign. In addition, pooling of resources enabled more activities to be conducted across geographical locations and stakeholder groups. Local coordination of activities was also much easier. Collaboration is a win-win implementing strategy.

At the height of the Bt maize trials, our seminars were held in potential field trial sites. We invited agriculture and fisheries committee members, potential institutional biosafety members, farmer-leaders, and key community personalities. We had several media workshops, too.

Our message was fairly consistent. Biotechnology can help improve farm productivity and can make our foods and environment safer. We needed our stakeholders to be informed, and to understand, appreciate, and use the products or services of biotechnology. Our topics included biotech 101, understanding GM crops and foods, safety aspects, and risk communication. As results of the field trials came in, the information on better yield and quality were included. With commercial planting of biotech maize, socio-economic aspects were also presented. Though we shared information on the experiences of other countries that decided to grow biotech crops, we observed that the interest of the participants perked more when presented with local data. Later, we complemented our person-to-person communication strategy by developing information materials, creating our website, providing electronic news service by covering Philippine media coverage on biotechnology-related developments, conducting visits to laboratories and biotech field trials and commercial biotech farms, and doing radio-based information sharing activities i.e. interviews, scripts, public service announcements, and plugs. We also distributed information materials developed by our partner agencies.

Eventually we increased our regional type of biotech outreach activities. With SEARCA's interest in biotechnology, we have gone into joint publications of monographs and books as well as co-organizing of conferences, seminars, and training.

We see more diversified biotech crops in the years to come. Some of these will be public sector-developed that would require a more deliberate approach to communication as the products

move from confined trials to multi-location field trials. Others will have three or more traits packed into a single crop. All these would need an adequate information campaign for the public to know and be able to decide for themselves the commercial fate of such products. As Plutarch said, 'This time, like all times, is a very good one, if we but know what to do with it.'

BBIC

• Supat Attathom

Thailand is one of the leading agricultural exporting countries. Introduction of modern biotechnology to improve the quality and quantity of agriculture production is deemed important. However, Thailand has to balance the use of technological development particularly genetic modification (GM) technology among various stakeholders. The main concern of policy-makers is how to protect the export markets where GM products are not yet welcomed.

The real challenge of Thailand Biotechnology and Biosafety Information Center (BBIC) is to provide information on modern biotechnology to concerned parties in the Thai language. At the initial phase (2000-2004), Thailand BBIC was affiliated with the National Center for Genetic Engineering and Biotechnology (BIOTEC) and much of the efforts were targeted for the science community. Today, it is hosted by the College of Agriculture, Kasetsart University, the country's leading agricultural university. With this new arrangement, Thailand BBIC now actively participates in public education and communication via seminars, workshops, newsletters and website (www.safetybio.agri.kps.ku.ac.th). The concept of "Live Classroom" has proven to be a very effective strategy for public education, especially for farmers where GM plants can be observed and studied. This involves raising public awareness on biotechnology through a tour of research and development efforts related to biotech crops starting with the laboratory to field trial sites.

The case studies presented by some BICs highlight the on-the-ground activities that have increased efforts to communicate concepts and issues on biotechnology. Communication strategies are common across the BICs. However, what distinguishes each BIC is how they use these strategies in the light of the uniqueness of their respective political and policy environment, stakeholder level of interest, and priority messages.

A crucial question that needs to be answered is whether communication efforts have met the said objectives. Evaluating efforts and assessing impact need to be done.

IX Evaluating Efforts and Assessing Impact

Did we meet our objectives? Did our activities attain our objectives? Did we make an impact with our communication efforts?

Evaluation of communication strategies is often a neglected but equally important task. It should be a continuous feedback mechanism at different stages of the communication process – evaluation can be done prior to, during, and after a communication strategy is implemented. Evaluation enables necessary adjustments to be made so as to avoid costly mistakes, duplication of efforts, and inability to meet objectives.

The evaluation scheme should allow both quantitative and qualitative information. Numbers such as visitors to a website, readership impressions, and articles published on crop biotechnology for example, are indicators. Other important measures can provide glimpses into trends and help gauge the use of various approaches.

Project Monitoring and Impact Evaluation. Progress of communication activities as it relates to the overall implementation plan must be continually monitored. Feedback about project implementation can then be fed back to the system to improve the process. Questions to be answered during monitoring include: Are we reaching intended stakeholders? Are they receiving the messages we identified? Are we on the right track? Answers to these questions can help determine alternative courses of action.

The workplan should have a list of expected activities and outputs or deliverables so that these can be assessed at various stages of the communication process.

An impact evaluation determines the overall effect of interventions to determine the degree of success or failure. It entails measuring the level of intended change in knowledge, attitudes, and skills.

An assessment of public perceptions provides a benchmark against which to measure the impact of a communication initiative. A sample of stakeholders who have been identified as 'key' audiences can be surveyed to determine conceptual

and behavioral changes (See previous discussion on surveys).

Communication Strategies. Different approaches and strategies used in communicating biotechnology can be evaluated to determine their impact and if the set objectives were attained.

Training and workshops. The effectiveness of a training or workshop and how it was implemented can be evaluated. Participants to workshops, training programs, and other group meetings are asked to fill out a questionnaire to determine their rating of various aspects such as workshop in general (relevance, organization, and effectiveness), group exercises, open fora, field visit, resource persons, workshop venue, hotel rooms, food, and management of the workshop. A rating scale of 1-5 where 5 is the highest and 1 is the lowest can be used as measure. Specific comments and recommendations are also asked. The data is processed and incorporated into the workshop proceedings and is used to improve future activities.

A post-workshop evaluation can also be done to see how knowledge and skills acquired during the workshop were used after a specified period of time. Six months after a risk communication workshop, participants were asked how the skills they learned helped them when they returned to their work. They gave specific skills such as being more confident during a television interview, being able to write a reply to a negative article on biotech crops in a newspaper, and answering queries from media.

Website. Measuring a website's usage is necessary to have a basis for determining how the site is perceived as useful by visitors. The Global Knowledge Center on Crop Biotechnology (KC) uses a software called AWStats to monitor and track website usage on a daily or monthly basis. Data generated include unique visitors, number of visits, pages viewed, hits, top countries viewing the site, visit duration, and top file downloads. An analysis can be made to determine the total number of people who visit the site at a particular period, the session of activity that a visitor does on the site, what materials he/she spends time on or downloads, and other related information. Google offers a free service called Google Analytics that generates detailed statistics about the visitors to a website (http://www.google.com/analytics).

Usability and usefulness are also measured using user polls and surveys, either through questionnaires on the website or through email (Haight, 2007). Possible questions on usefulness include: How do you rate the usefulness of this website? Does the website provide you with the information you need? If not, what information would you like to see? What content or features do you find important? How do you rate the design of the website? How satisfied are you about the website?

Every year, subscribers to the Crop Biotech Update are asked to fill out a short questionnaire about the e-publication through email. The responses enable the KC to profile its subscribers, and gather feedback. The profile of respondents gives some background information such as organization, country, and designation, hence an idea of who the readers are. Feedback such as categorization of news, font size of the newsletter, and general layout, give ideas on how to further improve the CBU.

Video. Pre-testing of videos can be done through focus group discussion. This involves inviting a mixed group of stakeholders, i.e. student, housewife, and researcher, to view the video and then asking them to react based on these variables: overall video presentation, clarity of message, visuals, audio, and voice over. Another approach is to test the video on workshop participants and then have them fill out a questionnaire, rating the variables on a scale of 1 (very poor) to 5 (excellent). The group's interest during the workshop is, in itself, a good gauge of the video's production quality and effectiveness as a communication medium.

Print/publications. Publications can be pre-tested with various

sample audiences to determine understandability of content, readability, design and layout, as well as overall impact. A rating scale of 1 (very poor) to 5 (excellent) is used. Respondents who represent the identified target of the publication are shown prototype materials in a near-final stage and then asked to fill out a simple questionnaire measuring these variables. Answers are processed and comments where feasible are added in the revised version.

Institutional/Internal Capability. A SWOT Analysis is a strategic planning tool to determine how an organization, say the BIC, is performing or will be able to respond to the needs of its stakeholders. A critical self-analysis of the organization is important to determine one's strengths (S), weaknesses (W), opportunities (O), and threats (T) from the environment. By analyzing these factors and seeing the interlinkages among them, it becomes easier to determine pathways or directions to attain objectives. It is also less of a problem to determine what communication strategies can be done as the BIC's capability to implement these are underscored. Thus, results of a SWOT analysis can be used to set objectives, develop and analyze existing strategies, and prepare plans for implementation.

An external review or experts' meeting is organized to allow experts to review and analyze, and come up with recommendations to improve and redirect goals, objectives, and strategies. For a potential BIC, the meeting can also be a venue to get perspectives on the directions that it should pursue based on the national political climate, biotechnology environment, and stakeholder interests and perceptions.

The KC was reviewed by an external expert who went through publications and communication outputs, interviewed respondents, and attended a network meeting. The reviewer described and analyzed the network in terms of audience, objectives, strategies, and impact. The highlight of the review is a list of recommendations that was used to refocus directions, and justify continued support for the program.

By evaluating efforts and assessing impact, organizations such as the KC and the BICs can distill a list of experiential lessons that enrich projects in communicating biotech.

X Synthesizing Lessons Learned

When the Global Knowledge Center on Crop Biotechnology and a few of the Biotechnology Information Centers began operations in late 2000, only a few other players were involved in communicating biotechnology. The KC network thus had a lead start in gaining prominence in the arena of biotechnology communication. It is now identified as a key player in communicating biotechnology globally. In the words of an external reviewer, "…no other place in the developing countries performs such functions as the KC does in this subject" (Castillo, 2003).

The network has had the opportunity to conceptualize, plan, and evaluate strategies aimed at increasing awareness and understanding of crop biotechnology as well as getting involved in efforts to share knowledge on the field in various levels - state, national, regional, and international. In the process many lessons were learned that enriched the field of science communication in general, and biotechnology communication in particular. In addition, ideas forwarded by experts have been incorporated into the following insights:

1. Communication is not merely a one-way process of dishing out information to people based on the assumptions that lack of understanding stems from inadequate information or that ample information can compel action. Rather, it involves social negotiation and dialogue between and among varied audiences – policy-makers, academics, scientists, and ultimately, consumers.

2. Biotechnology is an example of 'science in the making' and therefore likely to be provisional and controversial. Science in the making depends much more from those involved in the process of public understanding of science. The various 'publics' need to take an active role in the process of creating knowledge – hence, an informed discussion on science and biotechnology, regulations, safety issues, ethical dimensions, and socio-economic perspectives. In addition, equally important is the sharing not only of topics related

to crop biotechnology (science of biotech) but also the science and practice of science communication.

3. Science communication should be looked at as a dynamic process with various communication strategies as mere components. Communicators are not merely skilled people who are expected to process information. Instead, they must contribute to being part of the process of developing 'socially robust' knowledge and facilitating its development. They facilitate the process by which science understands the public and the public in turn, understands science. Ultimately, science communicators must be able to proactively attend to and respond to the nuances of their field of interest, i.e., biotechnology.

4. In embarking on any science communication initiative, it is important to take stock of the current environment for biotech taking into consideration scientific developments, political support, role of key players vis a vis biotech, and influence of stakeholders in the decision-making process. There is a need to identify issues considered most important to stakeholders, key information sources, information gaps that need to be addressed, barriers and opportunities to biotechnology acceptance in the country, among others. Goals are defined based on a global vision while objectives focus on local needs.

5. Identifying stakeholders is crucial. While it is tempting to reach out to as many clients as possible, limited manpower and resources necessitate the need to prioritize stakeholders. The local environment dictates which audiences to prioritize. Three major groups – the academic community, the media, and the government sector –are important. The academic community often serves as resource persons and is highly regarded as credible sources of information. The media is one of the most effective means of reaching the public and is a powerful institution in setting the science agenda. It is often the tri-media that is the primary source for information on science. Due to their role in legislation and policies, the government sector is a critical sector as well. The multiplier effect of communication enables other sectors to be reached.

6. The different 'publics' are not merely passive potential audiences for science communication but are active constituents of the system in which the scientific community thrives and functions.

7. Communication modalities or approaches are merely tools to facilitate communication. The choice on their use and frequency as well as combination of strategies is dependent on objectives, and stakeholders' needs and concerns. Evaluation is necessary to determine if we are gaining impact from the use of communication strategies.

8. The Biotechnology Information Centers should not start and end as mainly information centers. They should strive to be significant players in the development of enabling environments for informed decisions regarding the role of crop biotechnology in their respective countries. In addition, they need to set the stage for biotech crop adoption and commercialization.

9. The Biotechnology Information Centers while focused on specific country concerns, have the potential to create a bigger impact on a regional basis. Some BICs have been able to conceptualize projects that focus on stakeholders that transcend country-specific concerns, i.e. issues regarding Islam and biotechnology.

10. Together the Global Knowledge Center on Crop Biotechnology and the Biotechnology Information Centers have the potential to be a collective voice on crop biotechnology by consistently sharing key messages globally that are credible and compelling.

XI Conclusion

Bridging the knowledge divide between and among stakeholders is a crucial role in the acceptance of crop biotechnology particularly in developing countries that need it the most. It is equally important to ensure that different stakeholders have access to and are able to avail of science-based, up-to-date information to make informed decisions. Therefore, having an institutional mechanism in place as a conduit of knowledge sharing is essential to increase awareness and understanding of crop biotechnology. To attain these desired goals, the International Service for the Acquisition of Agri-biotech Applications (ISAAA) established the network of Biotechnology Information Centers under the umbrella of the Global Knowledge Center on Crop Biotechnology (KC). The network provides a systematic plan to adequately address specific interests and concerns in developing countries. This handbook highlights the importance of location specific strategies while keeping in view the global environment for communicating crop biotechnology. It also stresses the need to:

- Understand the scenario of agricultural biotechnology and the role of biotechnology communication;
- Identify and prioritize stakeholders, expected objectives, and corresponding communication strategies based on a participatory approach;
- Use a combination of communication strategies based on specific information needs and audiences;
- Evaluate and assess impact of communication strategies; and
- Learn from experiences in communicating biotech to continuously improve information dissemination efforts and sharing of knowledge.

The years of cumulative knowledge and experiences of the KC and the Biotechnology Information Centers have been documented in this handbook to show how they addressed challenges in communicating crop biotechnology. View these experiences not as a recipe book, but as a guidepost to chart the directions in communicating crop biotechnology.

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Annex

List of Biotech and Science Communication Resources

AfricaBio
Location: South Africa
Areas of interest: Crop biotech, biotech communication, etc.
Website: http://www.africabio.com/index.shtml
Contact: Remi Akanbi (Information Manager) remi@africabio.com

Agbios
Location: Canada
Area of Interest: A daily collection of global crop biotech news
Website: http://www.agbios.com/main.php
Contact: Morven A. McLean (President) mamclean@agbios.com
Donald J. Mackenzie (VP) djmackenzie@agbios.com

AgBio Forum
Location: United States
Description: Monthly journal of Agro Biotechnology Management and Economics
Website: http://www.agbioforum.missouri.edu
Contact: editor@agbioforum.org

AgBio World
Location: United States
Area of Interest: A daily collection of news and commentaries on ag-biotech
Website: http://www.agbioworld.org
Contact: C.S. Prakash prakash@agbioworld.org

Agricultural Biotechnology Support Project (ABSP-II)
Location: United States
Areas of Interest: Crop biotech, technology transfer
Website: http://www.absp2.cornell.edu
Contact: Andrea Besley (Communication and Outreach Director)
alm62@cornell.edu

Agriculture Network Information Centre
Location: United States
Description: Publishes biotech news items from various sources around the world
Website: http://www.agnic.org
Contact: agnicadmin@nal.usda.gov

Asian Food Information Centre (AFIC)
Location: Thailand
Description: Provides information on nutrition, health and food safety for the Asian Region
Website: http://www.afic.org

Biotech Knowledge Centre
Location: United States
Description: Publishes biotech articles from all over the world, also publishes the Crop Biotech Update
Website: http://www.biotechknowledge.com
Contact: Connie Vivrett (Managing Editor, Website) connie.l.vivrett@monsanto.com

Biotech Industry Organization (BIO)
Location: United States
Description: A biotechnology organization, providing advocacy, business development and communications services for more than 1,150 members worldwide.
Website: http://www.bio.org
Contact: info@bio.org

Biotechnology and Biological Sciences Research Council
Location: United Kingdom
Description: The UK's leading funding agency for academic research and training in the non-clinical life sciences
Website: http://www.bbsrc.ac.uk/

Biotechnology Online (Australian Government Initiative)
Location: Australia
Description: Provides biotech information, teaching materials assistance, etc. Maintained by the Australian Government agency Biotechnology Australia
Website: http://www.biotechnologyonline.gov.au/foodag/foodandag.cfm
Contact: ba@biotechnology.gov.au

CABI-AgBiotechNet
Location: United Kingdom
Description: Provides latest information about agbiotech research and biosafety
Website: http://www.agbiotechnet.com

CheckBiotech
Description: Provides information about rare diseases, life sciences, and biofuels and agricultural genetics
Website: http://checkbiotech.org

Co-Extra
Description: An EU supported program concerned with co-existence and traceability of GM crops
Website: http://www.coextra.eu
Contact: Claus Minol or Yves Bertheau info@coextra.eu

Consultative Group on International Agricultural Research (CGIAR)
Location: United States (headquarters)
Description: A strategic partnership, whose 64 members support 15 international centers, aiming to achieve sustainable food security and reduce poverty in developing countries through "scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment".
Website: http://www.cgiar.org
Contact: cgiar@cgiar.org

Commonwealth Scientific and Industrial Research Organization (CSIRO)
Location: Australia
Description: Information on Agbiotech research in the Australian region
Website: http://www.csiro.au/science/Crops.html
Contact: Beck Eveleigh Rebecca.Eveleigh@csiro.au
Huw Morgan (Manager, CSIRO Communications) Huw.Morgan@csiro.au

Council for Biotech Information (CBI)
Location: United States, Canada, Mexico
Description: "…communicates science-based information about the benefits and safety of agricultural and food biotechnology to sustainable development."
Website: http://www.whybiotech.com
Contact: agrobio@agrobiomexico.org.mx

Crop Life International (CLI)
Location: Belgium, United States
Description: Global federation representing the plant science industry and a network of regional and national associations in 91 countries.
Website: http://www.croplife.org, http://www.croplifeasia.org/ http://croplifela.org/cms/
Contact: croplife@croplife.org

EurekAlert Agriculture
Location: United States
Description: An online, global news service operated by AAAS, the science society, It provides a central place through which universities, journals, government agencies, and other organizations engaged in research can bring their news to the media.
Website: http://www.eurekalert.org/bysubject/agriculture.php
Contact: webmaster@eurekalert.org

European Association for BioIndustries (EuropaBio)
Location: Belgium
Description: An association with some 81 corporate and 5 associate members operating worldwide that aims to promote an "innovative and dynamic biotechnology-based industry in Europe".
Website: http://www.europabio.org
Contact: info@europabio.org

European Commission-Joint Research Centre (JRC)
Location: Italy
Description: Publishes information about deliberate field trials and placing on the market of genetically modified organisms
Website: http://gmoinfo.jrc.it
Contact: gmoinfo-comments@jrc.it

European Food Safety Authority (EFSA) - GMO Panel
Location: Italy
Description: Information on GMO approvals in the EU
Website: http://www.efsa.europa.eu/en/science/gmo.html
Contact: info@efsa.europa.eu

European Molecular Biology Organization (EMBO)
Location: Germany
Description: "…promotes excellence in the molecular life sciences in Europe through targeted programmes and activities."
Website: http://www.embo.org/index.html
Contact: embo@embo.org

FAO – Biotechnology in Food and Agriculture
Location: Italy
Description: Source of biotech information and publications
Website: http://www.fao.org/biotech
Contact: Shivaji Pandey (Chair, Inter-Departmental Working Group on Biotechnology) Shivaji.Pandey@fao.org

French Agricultural Research Centre (CIRAD)
Location: France
Description: Publishes a monthly e-magazine on agbiotech in developing countries
Website: http://www.cirad.fr/en/le_cirad/index.php
Contact: www@cirad.fr

GEO-PIE Project
Location: United States
Description: Provides educational materials exploring scientific and social issues associated with biotech
Website: http://www.geo-pie.cornell.edu
Contact: Bruce Lewenstein b.lewenstein@cornell.edu

Genetic Engineering Approval Committee (GEAC)
Location: India
Description: Information on GM crops license application procedures, field releases and biosafety
Website: http://www.envfor.nic.in/divisions/csurv/geac/geac_home.html

GMO Compass
Location: Germany
Area of Interest: Information on genetically modified organisms with focus on European Union countries
Website: http://www.gmo-compass.org
Contact: info@gmo-compass.org

FAO/WHO- Codex Alimentarius
Location: Italy
Description: Established to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme.
Website: http://www.codexalimentarius.net
Contact: Codex@fao.org

Foundation for Biotechnology Awareness and Education (FBAE)
Location: India
Description: Aims to create public awareness about the potential benefits and perceived risks of biotech intervention in human, animal and plant health, environment protection, etc.
Website: http://www.fbae.org

Information Systems for Biotechnology (ISB)
Location: United States
Description: Information hub on biotech research biosafety and regulatory issues in agbiotech
Website: http://www.isb.vt.edu
Contact: isb@vt.edu

International Centre for Genetic Engineering and Biotechnology-Biosafety
Location: Italy
Description: Compiles and disseminates selected document on biosafety and biotechnology
Website: http://www.icgeb.trieste.it/biosafety
Contact: biosafe@icgeb.org

International Food Information Council (IFIC)
Location: United States
Description: An Information hub on food biotechnology and capacity building
Website: http://www.ificinfo.health.org/index14.htm

International Food Policy Research Institute (IFPRI)
Location: United States
Description: "…seeks sustainable solutions for ending hunger and poverty." One of the 15 centres supported by the CGIAR
Website: http://www.ifpri.org
Contact: ifpri@cgiar.org

IFPRI- Program for Biosafety Systems (PBS)
Location: United States
Description: "…supports partner countries in Africa and Asia in the responsible development and safe use of agricultural biotechnology."
Website: http://www.ifpri.org/themes/pbs/pbs.htm
Contact: Mark W. Rosegrant (Division Director) m.rosegrant@cgiar.org
Catarina Cronquist (Program Analyst) c.cronquist@cgiar.org

International Service for the Acquisition of Agri-biotech Applications (ISAAA)
Location: The Philippines, Kenya, and the U.S.
Areas of interest: Crop biotech, technology transfer, biotech communication, and capacity building
Website: http://www.isaaa.org/
Contact: isaaa-seasia@isaaa.org

National Centre for Biotechnology Information (NCBI)
Location: United States
Description: Important resource for molecular biology information
Website: http://www.ncbi.nlm.nih.gov
Contact: info@ncbi.nlm.nih.gov

Nuffield Council on Bioethics
Location: United Kingdom
Description: Examines ethical issues raised by new developments in biology and medicine
Website: http://www.nuffieldbioethics.org
Contact: bioethics@nuffieldbioethics.org

Meridian Institute Food Security and Ag-Biotech News
Location: United States
Description: Daily news service covering the most important global developments related to agriculture and food security, with a strong emphasis on issues related to the controversy over agricultural biotechnology
Website: http://www.merid.org/fs-agbiotech

Organization for Economic Cooperation and Development - Biotrack
Location: France
Description: Database on GM crops, information related to the regulatory oversight of products of biotech and capacity building
Website: http://www.oecd.org/department/0,3355,en_2649_34385_1_1_1_1_1,00.html
Contact: news.contact@oecd.org

Science and Development Network (SciDev.net)
Location: United Kingdom
Area of Interest: News, views and information about science, technology and the developing world
Website: http://www.scidev.net
Contact: David Dickson editor@scidev.net

Seedquest (Global information service for seed professionals)
Area of Interests: Crop biotechnology, marker assisted breeding, intellectual property protection, crop protection, coexistence, seed coating technology, etc.
Website: http://www.seedquest.com/News.htm
Contact: info@seedquest.com, editor@seedquest.com smarcion@yahoo.com.br

South Asia Biosafety Project (SABP)
Location: United States, India, Bangladesh
Areas of Interest: Crop biotech, capacity building
Website: http://www.agbios.com/sabp_main.php
Contact: Imdadul Hoque (Bangladesh) imdadul@agbios.com
Viba Ahuja (India) vibhaahuja@biotech.co.in

United Nations Environment Program (UNEP)-Biosafety
Location: Switzerland
Description: Biotech and biosafety backgrounder, news, publications and training
Website: http://www.unep.org/Biosafety/Default.aspx
Contact: Alex Owusu-Biney (Africa Coordinator) alex.owusu-biney@unep.org
Fee Chon Low (Asia Coordinator) feechon.low@unep.ch

UNEP - Biosafety Clearing House (BCH)
Location: Canada
Description: "…a mechanism set up by the Cartagena Protocol on Biosafety to facilitate the exchange of information on Living Modified Organisms (LMOs) and assist the Parties to better comply with their obligations under the Protocol."
Website: http://bch.biodiv.org
Contact: bch@cbd.int

UNIDO - Biosafety Information Network and Advisory Service (BINAS)
Location: Austria
Description: Database on global development in regulatory issues and guidelines from many countries and capacity building
Website: http://binas.unido.org/binas/

United States Department of Agriculture (USDA) – Biotech
Location: United States
Description: Depository of USDA biotech publications
Website: http://riley.nal.usda.gov/nal_display/index.php?info_center=8&tax_level=2&tax_subject=8&topic_id=1067&&placement_default=0

USDA, Animal and Plant Health Inspection Service (APHIS)-Biotech
Location: France
Description: Provides information on US Biotech regulatory procedures, requirements for licence application and field releases
Website: http://www.aphis.usda.gov/biotechnology/index.shtml
Contact: biotechquery@aphis.usda.gov

USDA Agricultural Research Service (ARS)
Location: United States
Description: Aside from its daily ag-research news, ARS also publishes a monthly e-magazine on the recent developments in agriculture research
Website: http://www.ars.usda.gov/main/main.htm

United States Regulatory Agencies Unified Biotech Websites
Country: United States
Description: Focuses on the agricultural products of modern biotechnology, and provides database on GM crops
Website: http://usbiotechreg.nbii.gov/index.asp

World Health Organization – GM Food
Location: Switzerland
Description: Provides general information on a range of issues in the field of biotechnology and human health, including safety evaluation of vaccines produced using biotechnology, human cloning and gene therapy
Website: http://www.who.int/foodsafety/biotech/en
Contact: foodsafety@who.int

Recent Biotech Research Developments

American Association for the Advancement of Science http://www.sciencemag.org/

Nature Publishing Group http://www.nature.com/index.html

Nature Biotechnology http://www.nature.com/nbt/index.html

Proceedings of the National Academy of Sciences of the USA http://www.pnas.org/

Public Library of Science ONE (PLoS ONE, interactive open-access journal) http://www.plosone.org/home.action

Biotech Journals that Occasionally Feature Free Research Papers:

Transgenic Research http://www.springerlink.com/content/100225/p=69d67d16521742c38983510057cf12c6&pi=0

Plant Biotechnology Journal http://www.blackwell-synergy.com/loi/pbi

Plant Molecular Biology http://www.springerlink.com/content/100330/p=dc1ef97806cc4db9aaa3529646eb9ae5&pi=11

Molecular Breeding http://www.springerlink.com/content/100317/p=bf783c192be24e4b9542ec7119d5ba95&pi=0

Precision Agriculture http://www.springerlink.com/content/103317/

Plant Science http://www.sciencedirect.com/science/journal/01689452

Molecular Breeding http://www.springerlink.com/content/100317/p=bf783c192be24e4b9542ec7119d5ba95&pi=0

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