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Stakeholder Attitudes Toward GMOs in the Philippines, Mexico, and South Africa: The Issue of Public Trust

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Summary. — This paper investigates stakeholder perceptions and interests in the public debates on the risks and benefits of genetically modified organisms (GMOs) in developing countries. The surveys conducted in Mexico, the Philippines, and South Africa showed that most local stakeholders in these countries tend to have pragmatic views toward the use of GMOs. Yet, they also revealed a trend toward political polarization that is linked to the transatlantic dispute on GMOs. We argue that it is not just power politics but also the increasing competition for public trust that explains why European stakeholders turned out to be so successful in influencing attitudes and regulation on GMOs in developing countries. National academia, which proved to be the most trusted stakeholder in all three countries and less involved in foreign-funded advocacy work, may be crucial in abating political polarization and facilitate pragmatic political action.

Key words — stakeholder attitudes, developing countries, public trust, development assistance, NGOs, GMOs

1. THE POLITICS OF AGRICULTURAL BIOTECHNOLOGY

Few studies have analyzed the interests, perceptions, and values that induce a state or non-state actor to support or oppose the use of biotechnology in agriculture in developing countries. The only research that comes close to a stakeholder interest analysis was done by Paarlberg (2003). Paarlberg observes that developing countries have become a new battleground for proponents and opponents of genetically modified organisms (GMOs). [1] He provides some evidence on rich country governments and NGOs trying to influence developing countries' policy responses to food biotechnology. In this context, he points to the negative public attitude toward genetically modified foods in Europe and its political consequences for the rest of the world. He argues that due to the EU's economic weight and its commitment to multilateralism (Bernauer, 2004; Paarlberg, 2003), European stakeholders were successful in convincing not just their own countries but also many developing countries to favor a highly precautionary regulatory approach in dealing with the potential risks of transgenic crops.

A recent empirical paper by Cohen and Paarlberg (2004) confirmed a trend toward increasingly preventive regulation in developing countries. Paarlberg sees it as a confirmation that biotech critics from rich countries are likely to win the upper hand and prevent developing countries from taking advantage of the new technology.

In this paper we test Paarlberg's argument with data obtained from three stakeholder surveys on the risks and benefits of GMOs in developing countries. We then come up with a new theoretical approach that explains political polarization through the assumption that stakeholders' manage public trust as a private good in politics. The paper concludes that developing countries may be able to prevent ineffective political polarization by giving national academia a more active role in the public

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debate and the political decision-making process.

2. THREE SURVEYS ON STAKEHOLDER ATTITUDES TOWARD GMOs

The Philippines, South Africa, and Mexico were chosen for the three stakeholder surveys because they represent different political systems, cultural and historical roots, and stages of economic development. The choice of the three countries that grapple with the issue of agricultural biotechnology under very different circumstances gives more validity to the results of the surveys. The methodological approach is based on a unique combination of perception pattern analysis and social network analysis (Aerni, 2002; Laumann & Knoke, 1987). It is a tool to assess the perception, interests, and the political influences of the stakeholders involved in the national public debate on GMOs. These stakeholders, who claim to represent a particular constituency, help shaping public perception and political decisions and therefore are of crucial importance to the understanding of modern governance structures.

The surveys were funded by the Swiss Agency for Development and Cooperation (DEZA) and the Swiss National Science Foundation (SNF) and carried out in the years 1997 (Philippines) and 2000 (Mexico, South Africa), respectively.

The following section gives a short account of the public events and political changes that happened before and after the surveys were conducted.

In the Philippines, many of the political and economic reforms under Fidel Ramos in the 1990s were stalled under his successor Joseph Estrada who was ultimately swept from power through a second People's Power Revolution in 2001 (EDSA II). Gloria Macapagal Arroyo, the vice president who took office after Estrada's displacement, was finally elected president in 2004. The Philippines adopted biosafety guidelines and set up a National committee on Biosafety already in 1992, but these guidelines were only designed to regulate laboratory research and transboundary movements of GMOs. Many years had to pass before proper regulation of field trials and commercial application was in place. In 1997, when the survey was conducted, the Philippines did not yet approve any field testing or commercial application and the NGO movement against GMOs was organizing campaigns with international resonance (Aerni, 1999; Alegre, 1996). Only after EDSA II in 2001, the Filipino government adopted proper regulation for the commercial application of GMOs. Since 2002, Bt corn is grown in Mindanao despite organized protests, and new initiatives were started to promote agricultural biotechnology research.

In Mexico, the Partido Revolucionario Institutional (PRI) lost the elections in 2000 for the first time after 75 years to the Partido Accion Nacional (PAN). Vicente Fox, Mexico's new president, is facing many challenges that are related to the transition from a predominantly corporatist to a more pluralist political system. Regulation of agricultural biotechnology has also undergone significant changes. Mexico decided in the 1990s to regulate agricultural biotechnology through existing regulation related to environmental conservation and food safety. Transgenic products such as rBST (a growth hormone to increase milk production), tomato with increased shelf life, and Bt cotton and herbicide-resistant soybean were approved for full or partial commercialization already in 2000. Yet, a controversial study published in 2002 (Quist & Chapela, 2001) that reported the presence of introgressed transgenic DNA constructs in native maize landraces grown in remote mountains in Oaxaca, Mexico, resulted in a wave of negative publicity on GMOs, invigorated public opposition and stalled further approvals of transgenic crops. In 2005, Mexico finally passed its biosafety law (Nature Biotechnology, 2005). While permitting planting and sale of GM crops, the law will also provide for special labeling requirements of transgenic crops and a protection regime for indigenous genetic resources.

South Africa did not experience a change in government since the survey was conducted in 2000. The African National Congress continues to be the uncontested ruling party. The Genetically Modified Organisms (GMO) Act, passed in 1997 and implemented in December 1999, is the main piece of legislation dealing with trade, production, and R&D of GMOs in South Africa. It is based on an expert-ruled policy that pursues a rather permissive regulatory approach. In 2000, when the survey was conducted, South Africa already issued permits for numerous field trials with new transgenic varieties and approved several transgenic crops for commercial use such as herbicide-resistant soybean, Bt corn, and Bt cotton. Research institutes in South Africa also conducted trans-

genic research on various other crops (such as strawberry, sugarcane, and vineyards). In 2000, the NGO coalition against genetic engineering in agriculture criticized the government's regulatory policy for being too responsive to the demands of multinational companies and too secretive toward public inquiries about permits granted to cultivate GM crops. They advocated a more precautionary approach in the regulation of agricultural biotechnology, preferably a five-year moratorium. Biowatch SA has geared up its advocacy work in recent years by filing a lawsuit against the government for not providing the public with sufficient information about its approval process for GM crops and the location of field trials. Moreover, Biowatch SA has taken the lead in an open protest letter to the World Food Programme (WFP) and the US Agency for International Development (USAID), issued in May 2004, accusing them of denying Africans the right to reject genetically modified food aid. In spite of these more frequent and better-funded protest activities, the political and regulatory situation in South Africa did not change significantly (Njobeni, 2004). Although the South African government has now ratified the Cartagena Protocol on biosafety and made some minor adjustments in its labeling requirements for genetically modified food, it continues to be a firm supporter of agricultural biotechnology.

(a) *Selection of participants in the surveys*

The relevant stakeholder representatives in the public debates on GMOs in the Philippines, Mexico, and South Africa were selected with the help of local key informants who were familiar with the topic and the stakeholders involved in the public debate. These key informants were mostly researchers at local partner universities and journalists of the national press. These partner universities were the University of the Philippines Los Banos (UPLB) in the Philippines, Universidad Autónoma Metropolitana (UAM) in Mexico, and University of Cape Town (UCT) in South Africa.

(b) *Structure of the questionnaire*

In all three countries stakeholder representatives were asked to complete a questionnaire on the risks and benefits of agricultural biotechnology. The questionnaire consisted of four parts: In Part I, participants had to rate the importance of various problems in domestic agriculture and the potential of genetic engineering for solving these problems; in Part II, respondents were requested to judge seven positively and seven negatively worded statements with regard to the risks and benefits of genetic engineering in agriculture; in Part III, they were asked to assess public trust in the different institutions involved in the public debate on agricultural biotechnology. The answers to all these statements and questions were pre-structured with scales from one to five (e.g. one = total disagreement, five = full agreement).

Part IV of the questionnaire consisted of a policy network table that listed all stakeholders that were considered to be directly or indirectly relevant to the public debate on GMOs according to the views of the local key informants. Participants were asked to assess the political influence of the stakeholders listed and indicate if and how they co-operate with each of these stakeholders.

In this paper we present the important results obtained in Parts I and II of the questionnaire (on the perceived risks and benefits of GMOs and its potential in agriculture) and selected results from Part III (on public trust) and Part IV (on policy networks). A detailed discussion on the methodological issues of concern including the chosen structure and content of the questionnaire was published in an earlier stage (Aerni, 2002).

(c) *Survey response rates*

The selected stakeholder representatives were first contacted personally. After briefly informing them about the purpose of the survey, the institutional collaboration, and the funding sources of the project, incentives to participate were offered in form of a free copy of the final report and a workshop invitation to jointly discuss the interpretation of the survey results one year after the survey. It was assumed that the results would interest them since they also revealed how other stakeholders assess them in terms of influence on public opinion and political decision making. They were also assured that their views would be kept confidential and that they were not expected to reflect the view of the institution they represented. The selected representatives then either accepted or refused to participate, or they referred to a substitute within their institution who was more familiar with the subject. Depending on the preferences of those who finally agreed to

participate, the questionnaire was either sent by mail, e-mail, or handed over personally.

Table 1 shows that the survey response rates in all three countries were above 50%. The relatively low turnout in South Africa may have several reasons. First, the South African government and parliament (''legislature'') did not seem to play a very active role in the public debate on agricultural biotechnology in 2000. Instead, it was AfricaBio, a pro-biotechnology NGO with strong links to academia and the biotechnology industry on the one side, and Biowatch South Africa, an anti-biotechnology NGO with links to other NGOs and Churches on the other side, that dominated the public debate. Moreover, while Mexico is home to the International Institute for the Improvement of Maize and Wheat (CIMMYT) and the Philippines home to the International Rice Research Institute (IRRI), South Africa is not host to any headquarters of the Consultative Group of International Agricultural Research (CGIAR) which explains why its space for ''CGIARs'' remains void in the table.

In all three countries, a large share of the respondents belonged to government and non-government (NGO/Church) institutions. Government representatives were from the departments of environment, health, agriculture, and trade whereas non-government organizations comprised NGOs, farmer organizations, consumer organizations, and religious groups. ''Academia'' mainly consisted of professors from the fields of biotechnology, agronomy, and the social and environmental sciences.

''Business'' covered representatives from agribusiness, supermarket chains, and the biotechnology-, organic fertilizer-, and food industries. Moreover, the survey also included several stakeholders from ''Legislature,'' ''Press,'' and international NGOs and funding organizations (''Intl. donors'') to complete the picture. In spite of differences in participation rates, the shares of presumed proponents and opponents of agricultural biotechnology are balanced in all three countries (this was also confirmed by the participants themselves in the workshop one year after the survey was conducted). In countries where one side was more willing to participate, more efforts were invested in finding substitutes for those who were unwilling to participate on the other side.

Table 1. *Institutional affiliation of survey participants in South Africa, Mexico, and the Philippines*

	South Africa	Mexico	Philippines
Return rate (%)	55	72	81
Government	8	14	15
NGO/church	17	12	20
Business	9	7	8
Academia	12	8	5
Legislature	1	3	4
Intl. donors	1	2	3
Press		3	4
CGIAR		3	6
Total	48	52	65

(d) *Selected survey results*

Part I of the questionnaire was about the perception of the importance of different problems in agriculture and the potential of genetic engineering for solving these problems. The first question was: Which of the following problems in agriculture do you consider most important in your country? The second question went one step further by asking: How do you assess the potential of genetic engineering for solving these problems? In responding, the participants had to assess a number of problems that were listed in all three countries [2] on a scale from one to five; ''one'' indicated ''not important problem'' and ''no potential for genetic engineering'', respectively; ''five'' indicated ''very important problem'' and ''very high potential of genetic engineering for solving the problem'', respectively.

Figure 1 shows the aggregated average perception of the respondents in the Philippines, Mexico, and South Africa with respect to the importance of the problems in domestic agriculture. The *y*-axis shows the rating scale from one to five and the *x*-axis lists the 10 most relevant problems starting from the one perceived on average by all respondents to be most important and ending with the one perceived to be least important.

At this aggregated level, respondents in all three countries considered drought (*Drought*) to be one of the most, if not the most important problem in domestic agriculture, and genetic engineering was expected to have a potential for solving it. At the same time, market and infrastructure problems (*Market*, *Irrigation*, *Post-harvest*, *Transport*) also rank highly in importance, especially in the Philippines and Mexico. Yet, apart from helping to reduce post-harvest losses in the case of tomato with delayed ripening in Mexico, the potential of ge-

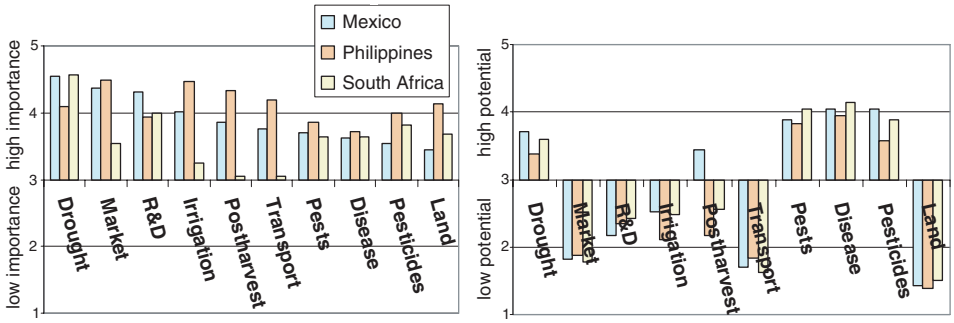

Figure 1. *The importance of problems in agriculture and the potential of genetic engineering for solving them.*

netic engineering to solve these problems was considered to be low.

Furthermore, respondents in the Philippines, Mexico, and South Africa stressed the potential of genetic engineering for addressing agronomic problems (*Pests*, *Diseases*, *Pesticides*). Agronomic problems were perceived to be important in all three countries, yet, only in South Africa they were considered to be more important than marketing and infrastructure problems. This might be related to the fact that the representatives of farmer organizations in South Africa mainly represented the view of large-scale white farmers (black farmer organizations were not involved in the public debate at that time and were not willing to participate in our survey because it did not belong to the priorities of their political agenda). Problems of land distribution (*Land*) were considered to be a very serious problem in the Philippines but less so in Mexico (which conducted several land reforms over the 20th century) and South Africa (where land reform is of more importance to black farmer organizations who did not participate in the survey). Lack of investment in public sector agricultural research and development (R&D) is considered to be a serious problem in all three countries.

Part II of the questionnaire consisted of selected positively and negatively worded statements regarding the potential risks and benefits of genetic engineering in agriculture. [3] The positive and negative statements were alternating in order to avoid a perceived framing bias and were adjusted to the particular circumstances in the respective country. They were phrased in collaboration with local partners and reflect the arguments frequently heard in the public debate. Figure 2 shows how these statements were evaluated on average by the respondents. The "radar" illustration is based on a scale from one (I don't agree at all) to five (I completely agree) in the form of concentric angular circles with the angle corners representing the different positive (+) and negative (−) statements.

A comparison of the aggregated results obtained in the three surveys revealed some interesting similarities in perception among stakeholders in the Philippines, Mexico, and South Africa. The results show that most respondents in the three countries considered biotechnology to be "*just a new tool* (+)" that helps solve problems that currently cannot be solved with conventional methods. They also agreed in general that genetic engineering in agriculture might eventually contribute to future "*food security* (+)" in developing countries and that genetically modified foods would not pose a serious "*health risk* (−)" for consumers. In turn, they expected the "*environmental risks* (−)" of transgenic crops to be rather serious (especially in Mexico and the Philippines) and were not happy with the current GMO "*regulation* (+)" in their country (especially in Mexico). The negative statement that the biosafety guidelines would not be enforced properly (*implementation* (−)) received the highest approval rate of all statements.

Unlike respondents in the Philippines and South Africa, survey participants in Mexico were on average more confident that pest-resistant crops may contribute to "*sustainability* (−)". Furthermore, Mexican respondents were more skeptical of the statement that "*organic farming* (−)" would be a better alternative for resource-poor farmers than their counterparts in the Philippines and South Africa. With the support of European donors, NGOs in the Philippines developed promising alternative

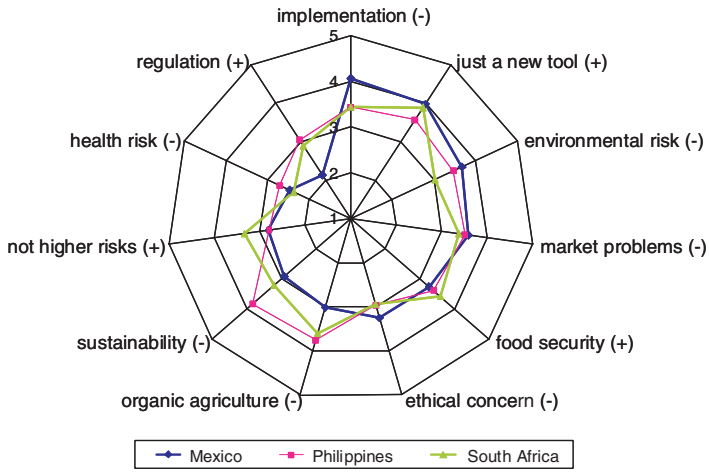

Figure 2. *Assessment of positively and negatively worded statements related to genetic engineering in agriculture.*

rice breeding and pest management programs in the 1990s in collaboration with local farmers to ensure sustainable food security; this may be an important reason for the great expectations regarding organic farming for resource-poor farmers in this country. Unlike in Mexico, the organic farming community in the Philippines is also closely linked to advocacy groups that oppose biotechnology in agriculture. In South Africa the reasons for endorsing this statement are likely to be different: The government's National Biotechnology Strategy (DACST, 2001) suggests that agricultural biotechnology is mainly seen as a tool to improve global competitiveness of domestic agriculture and therefore designed for cultivation on large, capital-intensive farms, rather than resource-poor farms in overcrowded small-scale agriculture of former Bantustans. Therefore, organic farming may be considered a better solution for resource-poor farmers by default. Part III of the questionnaires in Mexico and South Africa contained the question "To what extent do the following institutions enjoy trust in the public sphere?" Respondents had to rate a list of 13 institutions on a scale from one (no public trust) to five (total public trust).

Figure 3 shows the average trust ratings in these two countries with regard to the institutions that were listed in both countries.

In both countries, respondents considered academia to be the most trustworthy stakeholder, followed by civic interests groups such as consumer organizations, environmental NGOs, and producer organizations. The Church seems to be the second most trusted

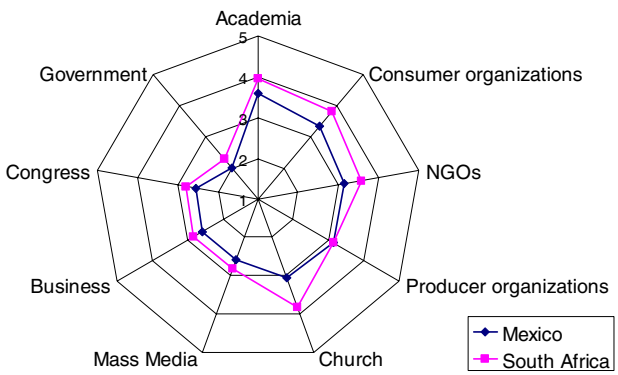

Figure 3. *Public trust in institutions (1 = low public trust, 5 = high public trust).*

stakeholder in South Africa, but is ranked behind the other public interest groups in Mexico. Trust in the mass media, business, the legislature, and the government seems to be equally low in both countries. Even though this particular question about trust in institutions was not asked in the Philippine survey, Part III in the Philippine questionnaire contained statements that indirectly emphasized trust in academia. For example, respondents agreed strongly with the statement that it is up to academic institutions to inform the public more about the risks and benefits of genetically modified food. They also thought that academia should assume a mediating role between opponents and supporters of agricultural biotechnology.

These results seem to indicate that the stakeholders in all three countries may have diverging political views but they would be willing to accept academic leadership in the public debate. The fact that academia is perceived to have more public trust than NGOs in the three countries contrasts with the findings in Global and European surveys (Eurobarometer, 2003; World Economic Forum, 2003).

(i) *Perception patterns*

A cluster analysis and a principal component analysis were conducted with the data obtained from Parts I and II in the questionnaire.

The pre-structured answers and statements in these two parts of the questionnaire were grouped into variables based on criteria of problem and statement similarity. The following seven new variables were created:

(1) *POTENA*: the potential of genetic engineering for solving agronomic problems (pest infestation, plant disease, high use of pesticides, fluctuating yield, high input costs, soil fertility).
(2) *POTENM*: the potential of genetic engineering for solving marketing and infrastructure problems (irrigation facilities, market conditions, support services, transport network, post-harvest losses).
(3) *POTENN*: the potential of genetic engineering for solving problems related to natural catastrophes (drought, flood).
(4) *POTENR*: the potential of genetic engineering for solving policy and long-term problems (comprising all the residual problems).
(5) *POTENTL*: the assessment of the economic impact of six different genetically engineered food products for small-scale and large-scale farmers.
(6) *POSITIVE*: positive statements regarding risks and benefits of genetic engineering in agriculture.
(7) *NEGATIVE*: negative statements regarding risks and benefits of genetic engineering in agriculture.

The Biplot, a visualization technique of the principal component analysis (Gabriel, 1981), allows to visually identify clusters of similar perceptions and, in addition, the perception of each single participant (letters) in the survey by its location in relation to different variables (vectors). The length of the vectors indicates the share of variance that is explained by the particular vector variable (Eigenvalue). The size of the angle between the vectors expresses the correlation between the vector variables (the smaller the angle the greater the correlation).

The respondents are represented by their institutional affiliation. Thus, the following groups were formed:

A	Academia
B	Business
C(O)	Consumer organizations
CH	Churches
I(F)	International foundation
ART	Artist
G(A)	Government (Dept. and Agencies)
I	International organization
L	Legislature
N	Non-governmental organizations
P	Producer organizations

The Biplot for stakeholder perceptions in the Philippines (Figure 4) shows three clearly distinguishable perception patterns (the circles added in the Biplot output indicate the results of the cluster analysis). The first group of stakeholders (Cluster 1) consisting mainly of national environmental and farmer organizations (N), international *NGOs* (IN) and other public interest groups appears to be largely opposed to GMOs [4] (they reject all the positively worded statements "*POSITIVE*" and endorse all the negatively worded statements "*NEGATIVE*"). They are also doubtful of any potential for solving agricultural problems through biotechnology for they reject all the variables that refer to the potential of genetic engineering in agriculture (*POTEN-N*, *-M*, *-R*, *-L*). The second group (Cluster 2), made up of scientists from agribusiness firms (B) and international (I) and national (G) research institutes, expressed a positive attitude toward genetic engi-

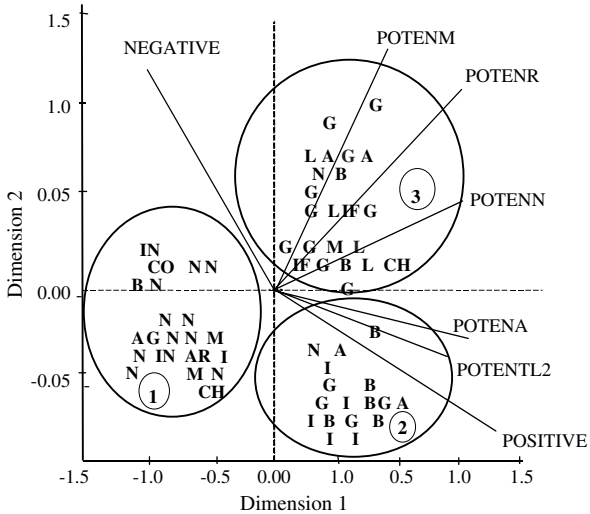

Figure 4. *Perception patterns in the Philippines (four observations missing* [9]*).*

neering in agriculture. They saw a major potential for genetic engineering to solve agronomic problems (*POTENA*) such as pest infestation and plant disease and also emphasized its potential contribution to economic development (*POTENTL*). The third cluster (Cluster 3) consisted mainly of government officials (G) and politicians (L). This group felt that biotechnology had a considerable potential for solving a wide range of agricultural problems but showed an ambiguous attitude toward the potential risks and benefits of transgenic crops (one part of the cluster tends to agree more with negative statements while the other part favors more the positive statements). This might reflect the Philippine government's ambivalent attitude toward agricultural biotechnology in 1997: former President Fidel Ramos was committed to the promotion of science and technology that formed part of his ''Vision Philippines 2000.'' At the same time, he tried to make political decision making more participatory by consulting more civil society groups that were generally opposed to the use of GMOs in agriculture. This was in part a result of the Philippines's strong commitment to Agenda 21, the general consensus document in support of the role of NGOs in sustainable development that formed part of the final declaration of the United Nations Conference on Environment and Development (UNCED) in Rio in 1992.

Figure 5 shows the results of the Mexican survey: the first cluster contains stakeholders with predominantly negative views toward GMOs, such as NGOs and other civic interest groups but also representatives from government agencies (concerned with biosafety and environmental issues) and academia. [5] The second and largest cluster includes scientists, government officials, politicians, NGO representatives, members of the business community, and representatives of international organizations. The perceptions of the respondents in this second cluster ranged from slightly critical to very favorable. The third and smallest group was even more in favor of agricultural biotechnology. It saw a potential of genetic engineering to solve problems in all the different problem categories and consisted of respondents from all institutional groups. Unlike in the Philippines, where the perception of most stakeholders turned out to be far from the center (in more extreme positions) and in accordance with institutional affiliation, Mexican stakeholders generally were closer to the center (in more moderate positions) and harder to define by institutional categories. This might be explicable by the two different political systems; the Philippines adopted a pluralist system in which different interest groups (mostly family clans) fight for improved access to the scarce public resources (Timberman, 1991) while Mexico inherited a corporativist system from PRI, the party that ruled Mexico for more than 70 years and also organised the large public interest groups such as consumer organiza-

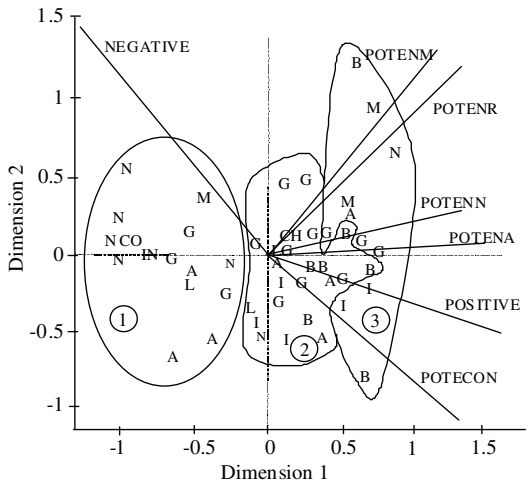

Figure 5. *Perception patterns in the Mexico (three observations missing).*

tions, trade unions, and farmer organizations (Krauze, 1997).

A similar picture is obtained for South Africa (Figure 6), where the distribution of clusters [6] and institutional representatives looks similar to those in Mexico with a large cluster in the center (Cluster 2) that contains representatives from all the different institutional groups and tends to be slightly in favor of agricultural biotechnology. However, in contrast to Mexico, academic representatives in South Africa had a stronger presence and were more in favor of GMOs. The representatives of environmental NGOs formed a compact group of strong outliers on the negative side (Cluster 1). The third cluster (Cluster 3) contains a small group of respondents that strongly favor genetic engineering in agriculture and see its potential also in solving marketing and infrastructure problems (*POTENM*) and long-term problems (*PO-*

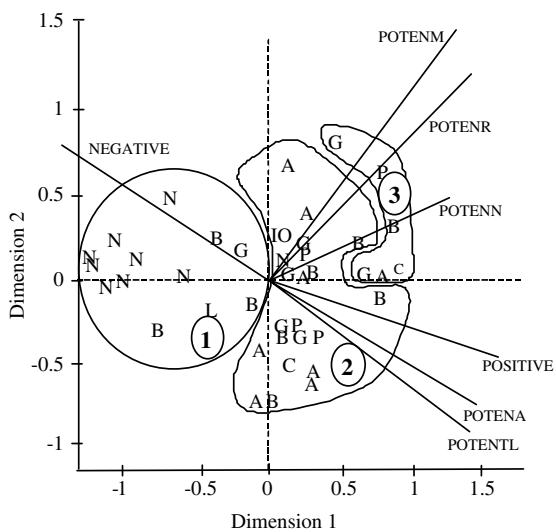

Figure 6. *Perception patterns in South Africa (seven observations missing).*

TENR). The few respondents from government agencies (who were also scientists) are found in all clusters and reflected the government's reluctance to participate in the public debate with a firm stance on GMOs. As a consequence, the debate was fought mainly between radical environmental NGOs and natural scientists joined by business groups. An interesting observation in South Africa is that consumer (C) and producer (P) organizations (here portrayed separately from the generic term NGO (N)) appear to have a positive attitude toward genetic engineering in agriculture. This was not the case in the Philippines and Mexico. As regards differences in perceptions within institutions, the results for all three countries indicate that there is a rift in perceptions within each institutional group: in academia, molecular biologists tended to be in favor, whereas social scientists and agronomists tended to be critical of agricultural biotechnology; in government, the ministries of trade, agriculture, and technology supported GMOs, while the ministry of environment opposed them; in business, the biotechnology and seed industry was more enthusiastic than supermarket chains and the food industry.

(ii) *Selected results from the policy network analysis*

In the fourth and final part of the questionnaire (Part IV), respondents were introduced to a policy network table that contained all the important stakeholders in the public debate. Respondents were first asked to review the list and complete it with additional names of stakeholders in case they considered the list to be incomplete. In all three countries, a few respondents added one or two organizations to the list. Yet, since no additional organization was mentioned by more than one respondent, it can be assumed that the lists were considered to be quite complete in all three countries.

Respondents were asked to assess the importance of each organization in terms of its influence on public opinion, political decision making, and the public debate on genetic engineering and indicate if and in what way they collaborate with the respective stakeholder. We will present here only a few selected results that show the important networks of collaboration.

The networks of financial and informal collaboration that were created among the actors involved were obtained by asking respondents to answer the following questions for each of the listed stakeholders:

Do you collaborate with this stakeholder? If yes, in what way?

(a) I give information	(b) I receive information
(c) I give financial support	(d) I receive financial support

Respondents (who themselves reflected a stakeholder in the table) were asked to answer this question for each stakeholder in the table by inserting the letter that reflects best the type of relationship. Displaying all the links of cooperation between the different organizations poses several problems: In case of a high participation rate, it was not possible to pack all relations between the different organizations into a visually clear illustration. Moreover, to assign each organization and its links to its respective institutional group would not provide a very useful picture due to the heterogeneity of perceptions, affiliations, and activities within the institutional groups. Figures 8 and 9 use the data obtained for the Philippines [7] to illustrate how the networks of information exchange and financial support can be illustrated in a clear way that allows us to quickly identify the important actors in the network. To avoid a dense maze of network relations, only the asymmetric relations (e.g. "a" I give information or "b" I receive information) were used in the calculation performed by the software programs UCINET and KRACKPLOT, while the symmetric relations (e.g. "a" *and* "b") were excluded. All in all, six networks of asymmetric collaboration were created (a–d). The networks a,b and c,d were then manually combined to create a network of information exchange and a network of financial support. A problem that emerges in these separate networks is the relatively low number of respondents that completed this time-intensive part of the questionnaire (about 60% in the Philippines). Yet, symmetrization of the asymmetric data helps to complete the missing links (e.g. if a respondent indicates that he gives financial support to a certain stakeholder then it can be assumed that this stakeholder would have indicated she receives financial support from him).

Figure 7 shows the network of information among the stakeholders involved in the GMO debate in the Philippines. The network shows that government departments such as the Department of Environment (GO3) and government agencies such as the National Food Authority (GA3) as well as academic institu-

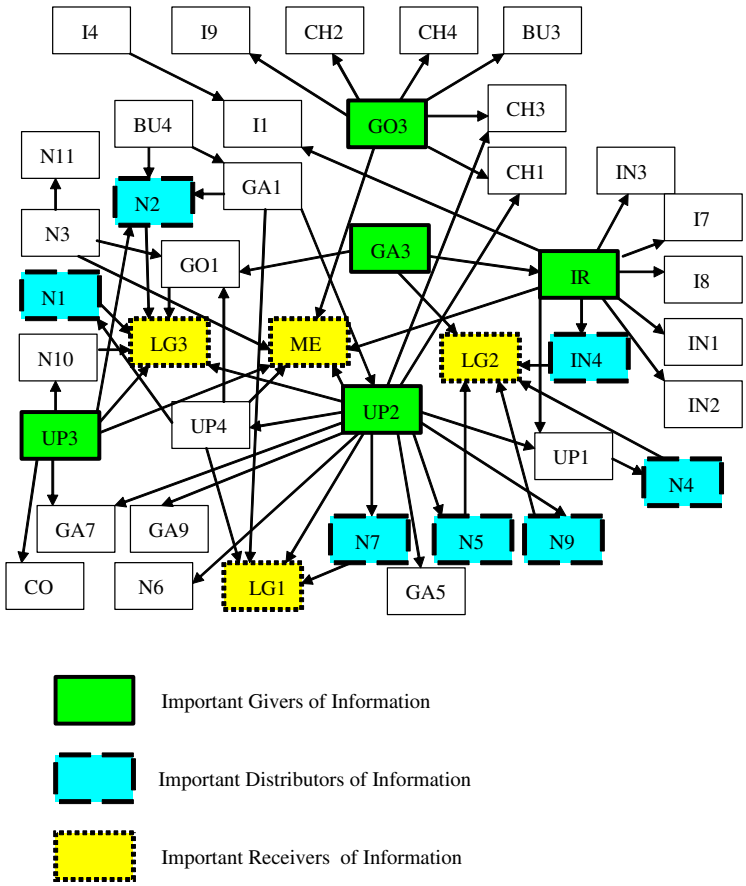

Figure 7. *Network of information in the Philippines.*

tions such as the UPLB (UP1, UP2, UP3), and the IRRI (IR) are the most important givers of information. In turn, members of Congress (LG3, LG2, LG1) and the National Print Media (ME) are the most important receivers of information. Numerous NGOs (N1, N2, N4, N5, N7, N9, IN4) stand out as the main distributors of information: they all receive information on GMOs from academic institutions (UP) and IRRI (IR), and interpret them according to their own views and pass them on as position papers to the Legislature (LG) and the Mass Media (ME). It gives an indication of how NGOs attract public attention through effective protest campaigns against GMOs that are based on position papers.

Figure 8 portrays the network of financial support in the Philippines. Unlike in the network of information, international organizations figure prominently in this network as the most important givers of funding (I1, I4, I6, I8, I9). They support IRRI (IR), academic institutions (UP) as well as government (GO) and non-governmental organizations (N). The Ministry of Science and Technology (GO5), the Department of Environment and National Resources (GO3) and as well as the Department of Agriculture (GO1) appear to serve as distribution hubs of financial support. They receive donations from international foundations (I) and give funding to academic (UP) and government research institutes (GA5). IRRI (IR) and NGOs (N) [8] appear to get their financial support mainly from international donors (I) and, as such, find themselves in direct competition for foreign funding. The strong dependence of national NGOs from foreign funding may affect their priority setting in advocacy work and the

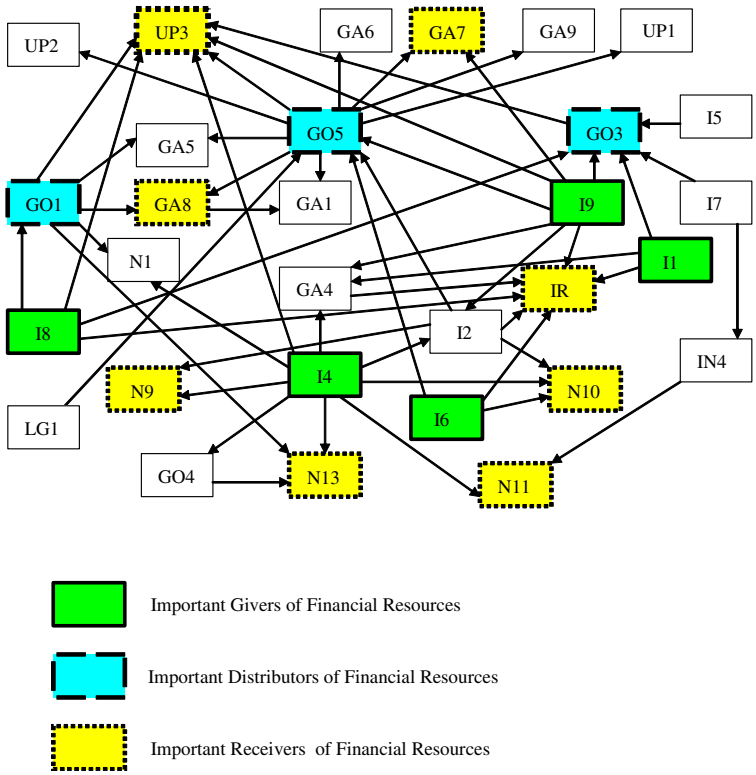

Figure 8. *Financial network in the Philippines.*

willingness to compromise with other local institutions in business and government.

If one compares the network of financial support in the Philippines with the one in Mexico (see Figure 9) it becomes obvious that, first of all, NGOs are less dependent on foreign donors. NGOs seem to be more important as distributors of financial resources (N3, N5) than mere receivers (N9). The direct involvement of global NGOs, such as Greenpeace (which has a local office in Mexico) may explain why the financial link between local and global anti-biotech actors is less clear in Mexico. The main receivers of financial support are academic institutions (A2, A5), government research institutes (GA5, GA8), and the International Maize and Wheat Improvement Center, CIMMYT (CY). The central actor in the receiving and giving of funding is CIBIOGEM (GA4), the intersectoral committee on biotechnology.

Due to the low participation rate in Part IV of the questionnaire it was not possible to create a network of financial collaboration in South Africa. A portrayal of all links of information exchanges (including the symmetric relations) revealed two core actors with almost two separate social networks. These two actors are the pro-biotechnology NGO AfricaBio on the one hand, and the anti-biotechnology NGO Biowatch South Africa on the other hand. Biowatch South Africa is linked mostly to other public interest groups, the legislature, international organizations, the mass media, the churches, artists, tribal leaders, and the Department of Environmental Affairs. AfricaBio's connections, in turn, included most of the government departments and agencies, academic institutions and as well as producer and consumer organizations. It indicated a clear separation of the Pro and Con networks. This was less obvious in the distribution of perception patterns and may indicate that perceptions and strategic political alignments are not always in harmony.

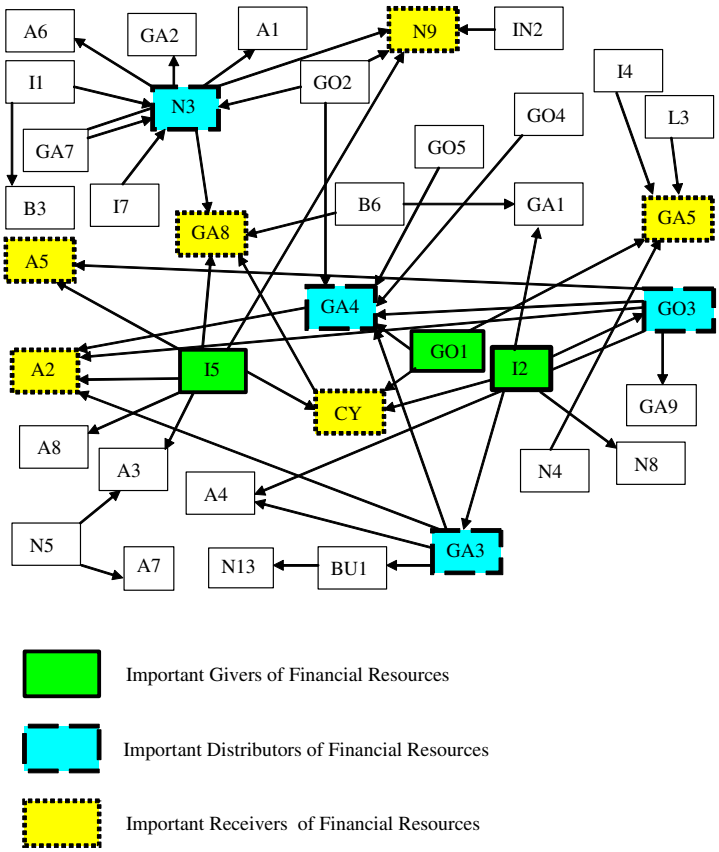

Figure 9. *Network of financial support in Mexico.*

3. THE PRIVATE MANAGEMENT OF PUBLIC TRUST

The three surveys revealed that a pragmatic attitude toward the risks and benefits of genetic engineering is prevailing in developing countries. The selected results of the biplot and policy network analysis indicated that the more extreme views in the public debate are likely to be funded by international networks of collaboration. The dependence on foreign funding and its impact on campaign priorities was revealed in personal interviews with local collaborators of international NGOs in Mexico and the Philippines who expressed a growing dissatisfaction with the prevailing franchising system in which the basic strategy of protest and the selection of protest topics are determined by the headquarters of NGOs in Europe or the United States while the local representatives are merely asked to execute the strategy without paying attention to local circumstances. This observation seems to chime well with the findings of Wahl's research on the franchising strategies of large international NGOs (Wahl, 1998) and the punitive actions of Greenpeace International against local Greenpeace offices that refuse to participate in certain international campaigns they consider inadequate for their respective countries (Der Spiegel, 2004). The recent announcement of Greenpeace Switzerland to shift more funding from national campaigns to campaigns in developing countries (Schuler, 2004) shows that even national branches of Greenpeace in Europe are increasingly interested in shaping public opinion abroad. These developments run counter to the general claim of NGOs to be driven by a bottom-up process. Yet, not just NGOs but also national governments in Europe seem to

be increasingly eager to politicize the subject of GMOs by funding radical opposition groups in developing countries under such benign-sounding initiatives as "food security and environmental quality," "biosafety capacity building," "strengthening civil society" or "empowerment." The official German Agency for Technical Co-operation (GTZ), for example, is supporting the anti-biotech activist group Biowatch SA in South Africa. This information was accessible not because GTZ was willing to confirm it but because Biowatch SA used to post it on its website (Aerni, 2005). Other international NGOs that are involved in anti-GMO advocacy work such as the International Federation of Organic Agriculture Movements (IFOAM) and Consumer International (CI) are also generously funded by various European government agencies. According to the CI Annual Report (Consumer International, 2005) 60% of its income received from donors in 2004 came from official development assistance agencies. The IFOAM sponsor website (http://www.ifoam.org/partners/sponsors/index.htm) reveals that five out of its 12 sponsors are German government agencies.

These observations indicate that normative stances often heard in the West in favor or against the use of agricultural biotechnology in developing countries are often more attached to vested interests rather than genuine concerns about poor people in developing countries. These vested interests are usually associated with transnational agribusiness companies who aggressively pushed for permissive GMO legislation in the 1990s. Yet, their lobbying and PR efforts seemed to have been largely ineffective in view of their controversial public image and the relatively low number of countries that have embraced transgenic crops in commercial agriculture. This stands in strong contrast to the success of large international, and particularly European NGOs in shaping a negative public opinion on GMOs through well-staged media-campaigns. In this regard, Paarlberg seems to be correct when he suggests that the European stakeholders against GMOs were more successful in persuading developing countries and international institutions to adopt their preferred preventive approach of GMO regulation (Paarlberg, 2003). But if this was really a successful example of power politics in which the European Union managed to export its regulatory approach through collaboration with civil society and multilateral institutions, then Paarlberg would also have to explain why it is so advantageous for Europe to reject agricultural biotechnology—and there seems to be a real contradiction. Why should Europe oppose a new technology that may eventually contribute to the transformation of the rather polluting agro- and petrochemical industry into a more efficient and clearer biological industry? Its highly constraining regulatory policy has already caused many skilled researchers in agricultural biotechnology to move to the United States and the stigmatization of genetic engineering has induced many European agribusiness firms to freeze their agri-biotech research programs (Lheureux *et al*., 2003). A plausible explanation might therefore not be related to power politics but to the increasing importance of public trust in the polarized debate on agricultural biotechnology.

In an affluent, complex, and uncertain world, people increasingly resent the presence of risks that are caused by decisions elsewhere and long for personal autonomy, orientation, and new certainties that allow them to interpret new events quickly and at low cost (Beck, 2000; Luhmann, 1979). Many public-attention-seeking right-wing (e.g. blaming immigrants) and left-wing groups (e.g. blaming new technologies and economic globalization) appear to address this demand successfully by reducing the complexity of issues and providing new certainties through the provision of scapegoats (Douglas, 1995). The result is a psychological interpretation of social matters: what makes a social action good is the character of those who engage in it, not the action itself (Sennett, 1976). As a consequence public actors are increasingly judged by their presumed motives rather than their performance (Lipset & Schneider, 1983). Since the European public trusts the motives of Anti-GMO-campaigners to fight for the public interest, they have acquired "public trust," not least by spreading distrust toward decision makers in business and government who are portrayed as self-interested and indifferent toward public concerns. In other words, it is no more necessary to conduct investigative journalism and attack companies for what they do (based on the evidence gathered), but to just denounce them for what they stand for. "Public trust" is therefore increasingly managed as a private good that ensures public legitimacy and allows an organization to survive in the public arena. Public trust can therefore be regarded as a scarce political resource like

"money" and "power." As a consequence, governments and multinational corporations (who represent power and money) tend to court protest organizations (who have gained public trust), respond to their concerns and offer bargains in the hope of being dropped as a target of protest. Yet, unlike money and power, public trust is not a tradeable good; once a protest group would be willing to exchange public trust for political power or money (e.g. by endorsing the pro-GMO policies of certain governments or multinational companies) the public would cease to regard this group as acting in the public interest and would withdraw public trust immediately. This may explain why NGOs that are focused on advocacy work and whose main political asset is public trust, as confirmed by various surveys (Eurobarometer, 2003; World Economic Forum, 2003), rarely seek bargains with government or industry. Willingness to compromise, for these actors, would mean to abandon an important protest topic and run the risk of being associated with those who are being denounced as enemies of the public interest (Luhmann, 1993).

The uncompromising behavior of many advocacy groups, motivated by efforts to appropriate public trust, has also led to changes in the strategies of business and government. Business is embracing corporate social responsibility strategies that tend to portray them as concerned charities rather than profit-oriented companies (The Economist, 2005), and governments tend to endorse the popular political positions of advocacy groups in the hope of impressing voters as concerned citizens that are highly skeptical about the process of globalization; the main aim of these strategies is to be perceived as less self-interested and therefore more trustworthy in public. It is based on the fatal insight that public trust can no more be gained by delivering value for money but only by pretending to have good motives and act in the public interest.

4. EXTENDING THE MORAL BATTLEGROUND

The opening of a new battleground in poorer parts of the world by the agri-biotech proponents and opponents in the United States and Europe observed by Bernauer (2005) can be interpreted as an attempt to appropriate and leverage public trust in their respective domestic debates. It is important to be perceived at home as acting in the interests of the poor and the environment in developing countries and that this is confirmed by presumed representatives of the poor in these countries. As a consequence, supporters and opponents in Europe and the United States often select and train representatives from developing countries whose views and interests coincide with their own, and encourage them to speak in the name of all the local stakeholders in their country (Aerni, 2002). As a result there has often been an over-simplification of the way the risks and benefits of agricultural biotechnology is seen in the South. Corporate press releases and NGO position papers are further entrenching this simplification by publicly portraying the role of agricultural biotechnology in developing countries, either as a curse or a possible salvation to the poor and hungry people in Africa.

5. RESPONSES IN DEVELOPING COUNTRIES

The main view common to most stakeholders interviewed personally in the three surveys was that Europe and the United States should assist researchers in developing countries to learn how to use agricultural biotechnology to address the urgent problems in their country. Once developing countries are able to address their urgent problems in agriculture with their own products, agricultural biotechnology may be perceived as a homegrown rather than an imported technology and, consequently, will find more supporters also among nationalist politicians. This argument finds further confirmation in the fact that the public attitude toward GMOs in developing countries with advanced capacities in biotechnology research such as Cuba, Colombia, China, India, and Thailand proved to be even more positive than in the United States (Hoban, 2004). Even though it is very difficult to convert interesting crop research conducted at local research institutes and universities into useful products for farmers, more investment in training, collaboration with the private sector, and experience in complying with the regulatory requirements may help changing the situation soon (Cohen, 2005). The new initiatives launched this year by the UN Millennium Development Project Task Force on Science, Technology, and

Innovation (MDP/STI, 2005) and the UK Commission for Africa (2005) intend among other things to re-define the role of universities in development strategies and promote science, technology, and innovation in the developing world. It may be a first sign, that the real demands of the developing world finally get more attention within the international donor community; it would also be a strong indication that rhetoric might finally be replaced by action.

6. CONCLUSIONS

The survey results presented in this paper show that most of the stakeholders that participated in the public debates in the Philippines, Mexico, and South Africa believed that agricultural biotechnology had the potential to solve important problems in agriculture and did not pose a significant health risk to consumers. Yet, there were also concerns regarding the potential negative impact of such crops on the natural environment and the difficulties of implementing strict regulation. Overall, a majority of the respondents proved to have a rather pragmatic view emphasizing the potential of genetic engineering to address important problems in agriculture such as drought, pest infestation, plant disease, and high use of pesticides but also pointing out the importance of non-agronomic problems such as lack of market access, R&D investments, and infrastructure. The results of the surveys suggest that the differences in perception in the Philippines, Mexico, and South Africa were often related to different historical, political, ecological, and socio-economic conditions. Even though all of these countries have undergone some political changes and experienced some resonating media events related to genetically engineered crops, before and after the surveys were conducted, none of these countries has decisively changed its basic direction in dealing with the new challenge of agricultural biotechnology.

The results obtained in the policy network analysis revealed that many local NGOs that are active in protesting against or promoting agricultural biotechnology have established links to western stakeholders (NGOs and international organizations), which play a key role in the choice and distribution of information through their organized campaigns. As a result, many of these local NGOs tend to adopt the political agenda of their foreign donors and often abandon their initial struggles for particular local concerns. The policy network analysis suggested that this is particularly true for anti-biotech NGOs that are mostly sponsored by European stakeholders. This result seems to be in accordance with Robert Paarlberg's argument (Paarlberg, 2003) that Europe has successfully exported its preventive GMO regulatory system to developing countries by working through multilateral institutions and in collaboration with civil society groups. However, this argument does not explain why Europe should have an interest to export its preventive regulatory system and reject the use of agricultural biotechnology. We argue that it is the competition for public trust rather than power politics that induces European stakeholders to win over stakeholders in developing countries. Public trust is defined as a political resource like money or political power. Yet, since public trust cannot be exchanged for money or political power, it fuels political polarization—and it is this polarization that is exported from Europe to developing countries.

Paarlberg also portrays developing countries largely as victims of foreign interference and does not address the potential of domestic academic leadership in the public debates on agricultural biotechnology in developing countries. Respondents in the three surveys believed that the public still trusts national academia more than NGOs and other public interest groups and as such enjoys considerable public authority. Academia may use this valuable political resource of public trust to curb foreign interference and create a domestic consensus to pursue a more pragmatic way in selectively promoting the use of biotechnology to address certain problems in domestic agriculture that cannot be solved through conventional breeding methods. In their 2005 reports, the UN Millennium Development Project Task Force on Science, Technology, and Innovation (MDP/STI, 2005) and the UK Commission for Africa (2005) have recognized the important role of academia in developing countries and advocate a substantial increase in funding for institutions of higher education in the developing world. If their recommendations will be adopted by the major national and international donor agencies, then the political deadlock about the use of GMOs in developing countries might eventually be resolved thanks to the more influential mediator role of academia.

NOTES

1. The term GMO is often used in a misleading way when applied to food. For example, according the US Food and Drug Administration, the term "GMO free" may be misleading on most foods, because most foods do not contain organisms (seeds and foods like yogurt that contain microorganisms are exceptions). Moreover, most, if not all, cultivated food crops have been genetically modified in a minor way (US FDA, 2001). However, the term GMOs is increasingly used in national and international affairs to refer to agricultural and food products containing bioengineered material. The term GMOs is widely used in the European Union and developing countries (South Africa even calls its legislation on transgenic crops and food the "GMO Act").

2. The problems used in the questionnaire are listed in Appendix A.

3. The exact statements are listed in Appendix B.

4. Cluster 1 also contains respondents from business (B) representing the organic farming business, from Academia (A) representing the agronomy department of UPLB, from the Mass Media (M) representing a national daily, and from Government (G), representing the Philippine Council for Sustainable Development (which contains government and non-government representatives). The Church representative (CH) represents the protestant church.

5. Clusters 2 and 3 seem to be particularly interweaved. Yet, according to the Mahalanobis Distance Test there is still a significant statistical difference between these two clusters. The Prob > Mahalanobis Distance gives a significant difference of squared distances between two clusters. The pairwise comparison (Cluster 1 *vs.* 2, Cluster 1 *vs.* 3, Cluster 2 *vs.* 3) shows significant probabilities ($p < 0.0001$), which indicates that the squared distances between clusters are significantly different from each other (which makes a good separation of the groups).

6. The expected R^2 of the clusters is equal to 0.67, which means that 67% of the variance is accounted for by the clusters. The multivariate test (using Wilk's lambda statistic) for differences among the clusters turned out to be highly significant ($p < 0.001$).

7. The fact that we had by far the highest number of respondents in the Philippines (65) also helped to get a relatively high number of assessments in the policy network table.

8. An exception is N13 which receives support from two government institutions (GO1, GO4). This is because N13 represents PRRM, one of the most respected and oldest NGOs in the Philippines, which has also close ties to the government (PRRM Directors were also appointed as ministers in the government).

9. Missing values are the result of incomplete answers in the questionnaire. If certain statements were not rated, certain variables did not yield useful results, and as a consequence, the respondents could not be located properly in the two-dimensional landscape.

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APPENDIX A. AGRICULTURAL PROBLEMS LISTED IN THE QUESTIONNAIRES IN THE PHILIPPINES, MEXICO, AND SOUTH AFRICA

Label	Problems listed in the Philippines, Mexico, and South Africa
Drought	Drought
Pesticides	High use of pesticides
Post-harvest	Inadequacy of post-harvest facilities
Input	Indebtedness of farmers due to high input costs
Transport	Inefficient transport network
Irrigation	Insufficient irrigation facilities
Market	Market conditions (low prices, cartels, importation etc.)
Pests	Pest infestation
Disease	Plant diseases
Land	Unequal land distribution
R&D	Too little investment in research and development

APPENDIX B. COMMON POSITIVE AND NEGATIVE STATEMENTS LISTED IN THE QUESTIONNAIRES IN THE PHILIPPINES, MEXICO, AND SOUTH AFRICA

Label	Statements listed in the Philippines, Mexico, and South Africa
Implementation	The implementation of the biosafety guidelines/GMOact is not well ensured
Just a new tool	Genetic engineering is just a new tool that enables breeders to solve problems that currently cannot be solved by traditional breeding methods
Environmental risk	There is a potential ecological risk that… Bt rice (Philippines)/Bt cotton (South Africa) will negatively affect beneficial non-target organisms Bt maize (Mexico) may outcross spontaneously with wild or conventional rice and will therefore affect biodiversity
Market problems	Because of an inefficient marketing system, producers of transgenic crops will not increase revenues nor will consumers profit from lower prices
Food security	Genetically engineered rice (Philippines)/corn (Mexico, South Africa) could help ensure future food supply in Asia/Latin America/Africa
Ethical concern	Genetic engineering in agriculture poses a serious ethical problem
Organic agriculture	Integrated pest management/organic farming is a better strategy to enabling resource-poor farmers to ensure their own food security
Sustainability	The potential of stem borers to overcome the built-in resistance of Bt rice/corn questions sustainability
Not higher risks	Genetically engineered varieties do not present higher risks for farmers than conventionally bred varieties
Health risk	Bt crops pose a health risk for consumers
Regulation	The biosafety guidelines/GMO act are clear, stringent, and impede abuse of genetic engineering