Public Attitudes towards Agricultural Biotechnology in Developing Countries

A Comparison between Mexico and the Philippines

STI Research Report

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Contents

Summary

Though the public debate on the potential risks and benefits of agricultural biotechnology is discussed globally, it is often reduced to a transatlantic debate with the United States as the main producer of bioengineered crops and Europe as the main opponent to such crops. Developing countries often find themselves in an uncomfortable position in the middle.

The aim of this paper is to portray the views on agricultural biotechnology expressed by the political stakeholders involved in the public debates in developing countries. The empirical part is based on two surveys conducted in Mexico and the Philippines.

The study shows that most of the respondents to the surveys consider biotechnology a powerful new tool to address problems in agriculture, nutrition and the environment, and they do not seem to share Europe's fear of potential health risks for consumers. In turn, they are concerned about corporate control of the technology, and the potential impact of such crops on their countries' rich biological diversity.

Instead of simply importing bioengineered crops from industrialized countries, they would prefer to create their own domestic research capacities. This would enable them to design varieties that are most appropriate to their problems in agriculture. However, this would require a strong commitment of industrialized countries to support these efforts.

In general, the surveys indicate that existing expectations and concerns regarding agricultural biotechnology in developing countries differ significantly from those expressed in the transatlantic debate. At the same time, there are also different perceptions among developing countries. For example, a majority of the Filipino stakeholders consider a domestically developed form of organic farming a better alternative to agricultural biotechnology for resource-poor farmers to ensure their own food security, whereas this is not the case in Mexico. While both countries consider marketing and infrastructure problems to be very important, Mexico considers drought to be the most serious problem in agriculture and genetic engineering is expected to make a significant contribution towards solving this problem. In both countries, agricultural biotechnology is considered to help solving other important problems such as plant infestation, plant disease, and high use of pesticides.

Our conclusions indicate that a global system of governance of agricultural biotechnology cannot just rely on Western views, if it is to minimize the risks and maximize the benefits of this technology. Such a system needs to consider the perspective of the stakeholders in developing countries to a much greater extent.

Abbreviations

ADB	Asian Development Bank
BID	Banco Interamericano de Desarollo
BIODEM	Biodiversidad y Desarollo de México
CGIARs	Centers for International Agricultural Research
CIBIOGEM	Comisión Intersectretarial de Bioseguridad de Organismos Genéticamente Modificados
CIMMYT	Centro de Investigación para el Mejoramiento de Maize y Trigo (International Maize and Wheat Improvement Center)
CINVESTAV	Centro de Investigación de Estudios Avanzados del Instituto Politecnico Nacional
CNBA	Comisión Nacional de Bioseguridad Agrícola
CNC	Confederación Nacional de Campesina
CONABIO	Comisión Nacional de Biodiversidad
CONACYT	Consejo Nacional de Sciencia y Tecnología
INIFAP	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias
IRRI	International Rice Research Institute
NGO	Non-governmental organization
PAN	Partido Acción Nacional
PCARRD	Philippine Council for Agriculture, Forestry and Natural Resources and Development
PhilRice	Philippines Rice Research Institute
PRI	Partido Revolutionario Institucional
UAM	Universidad Autónoma Metropolitana
UNORCA	Unión Nacional de Organizaciones Regionales Campesinas Autónomas
UPLB	University of the Philippines in Los Baños

Illustrations

Tables

Public perception, factual knowledge and interests

Until the mid-20th century, science and technology-driven modernization enjoyed wide public acceptance worldwide. Government regulators and scientific experts were trusted to manage the potential risks involved with the use of new technologies and the commercialization of the products derived from these technologies.

Scandals related to unsafe new drugs, environmental pollution, and the growing concern about the risks of nuclear technology resulted in a growing risk perception gap between experts and lay persons in the 1960s and 1970s. While experts relied in their risk judgment on calculative risk/benefit analysis and technical risk assessment, the risk perception of lay persons implied also social and psychological aspects. Following the psychometric paradigm, risk researchers analyzed the cognitive structure underlying the risk perception of the lay public with respect to potential hazards containing different risk characteristics [1]. According to findings based on empirical research, qualitative risk characteristics (e.g. personal control, voluntariness, familiarity, expected consequences of potential hazards, etc.), semantic images associated with the meaning of technological risks (e.g. pending danger, slow killers, cost/benefit ratio, avocational thrill, etc.) and immediate affect determine the public perception of risk [2], [3], [4].

However, most information about risk is not learned through personal experience but through 'second-hand' learning. The increasing complexity of technologies and the advances in scientific measurement, which allow the detection of even the smallest quantities of harmful substances, force people to rely increasingly on institutions that handle these risks. Regulatory and research institutions which are in charge of conducting risk assessment, management and communication provide the public with factual knowledge about the measurable risk characteristics, explain the strategies of how to minimize risks and maximize benefits and address public concerns regarding social implications. However, the negative risk perception towards high technologies has even increased in the last decade indicating that the public does not seem to be assured by the way experts handle technical risks.

The ecological crisis in the 1980s may have created a more critical attitude in the general public towards technology-driven modernization. People started to become skeptical towards the large-scale use of technology because of potential unintended side effects to the environment and human health, which could not be anticipated by calculative measures. Since these unintended side effects were considered to be involuntary, unobservable, and uncontrollable, people started to loose faith in the manageability of

high technologies [5]. Though there was a rather quick institutional response to minimize risk and uncertainty through additional regulations, new investment in alternative technologies, new control measures and more public participation, this could not appease the new feeling of uncertainty in public. The emergence of biotechnology in agriculture, is, on the one hand, seen as a new alternative technology, that can minimize the uncertain risk of pesticides and chemicals on health and environment. On the other hand, it is seen as a new technology than may result in new unintended side effects.

Social movements that protest against biotechnology, focus in particular on these potential unintended side effects. The protests are an expression of the uneasiness of society at large, but at the same time they amplify the concerns by creating symbolic events targeting certain stakeholders, who are accused of pushing technology and not caring about the public concern. Such events are considered newsworthy by the mass media, which tends to present it in form of a dramatic story portraying heroes, victims, and scapegoats [6]. This process of social risk amplification may result in tremendous social and economic costs for industry and government, and influence future investments and research priorities [7].

If such events accumulate to a certain threshold level, the lay public begins to distrust regulatory agencies and prefers to rely on the information given by other non-traditional political stakeholders that are believed to represent their concerns and interests. In this context, the inadequate handling of food risks[1] (unrelated to genetic engineering) by private companies and governmental agencies in Europe may have contributed to a loss of faith in the institutional capacity of governments to manage potential health risks associated with genetically modified food. These scandals created a perception, in particular in Europe, that people would be the victims rather than the beneficiaries of agricultural biotechnology. As a consequence the question: 'how safe is safe enough?' is now dominating the debates in Europe. The strong public risk aversion is also reflected in the creation of a new regulatory bureaucracy on biosafety and the use of an extreme version of the precautionary principle that enables governments to postpone politically risky decisions on the introduction of biotechnology in food and agriculture.

However, the global issue of trust in the case of agricultural biotechnology goes beyond institutional performance. The various attempts to improve risk communication by means of new forms of public participation could not prevent increasing polarization in risk perception and an erosion of public trust in institutions that create or manage

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[1] Several scandals occurred in Europe in the 80s and 90s were related to inadequate food safety control such as Anti-freeze agent found in Austrian wine, mad cow disease, Dioxin and PVC in Belgian eggs and meat products, contaminated Coke in Belgium and France, and, most recently, foot and mouth disease.

biotechnology products. The loss of trust is attributed to divergent world views[2] and interests. As a consequence, the public debates about agricultural biotechnology are moving away from factual knowledge and, in extreme cases, are not even about risk. Risk debates have become either a rationale for actions taken on other grounds or a surrogate for social or ideological concerns. Agricultural biotechnology in Europe is strongly associated with the power of multinational corporations, and mostly seen as an American technology, which is imposed on them. Though this may also be a matter of concern, it is not directly related to the risks of agricultural biotechnology. After all, not just the United States, but also China and Cuba are promoting the technology aggressively. A debate on agricultural biotechnology that is conducted on this worldview level often renders communication about risk simply irrelevant [8].

Agricultural biotechnology has become increasingly stigmatized through the process of social risk amplification and its perceived attachment to powerful interests. These episodes of stigmatization evoke images that are tagged to negative feelings [9]. As a consequence agricultural biotechnology is exclusively seen as a risk that is imposed, unnecessary, and potentially catastrophic for human health and the environment. And those who defend the potential benefits are seen as either simply naive or representatives of corporate interests.

On the other hand, it would be misleading to think that affective and emotional judgments are not important and should not be considered. Technical experts also have a blind eye and do often not anticipate the social implications resulting from the large-scale introduction of a powerful new technology. In this context, the critical public attitude towards agricultural biotechnology has forced the industry, regulatory agencies and international organizations to respond to concerns related to distributional justice, accountability and transparency in democratic societies, ethical values and the potential impacts on biological diversity. The industry responded with additional innovation such as new techniques that are designed to minimize the potential impact of genetically modified crops on biological diversity (e.g. expression of the genetic information in the chloroplast instead of the cell) and the perceived risk to human health (e.g. replacement of antibiotic markers). New approaches emerging from the field of genomics may potentially enable scientists once to create certain traits in crops without the need to insert a foreign gene. Moreover, more public participation is taking place, and new forms of private-public research partnerships and collaborations with developing countries are being explored in order to facilitate better technology transfer and create incentives to design crops that are in particular valuable and affordable for resource-poor farmers. Last but not least, companies increasingly learn to be more sensitive towards public concerns

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[2] Worldviews can be defined as a general attitude towards nature, existence, human activities and social organization. They are 'orienting dispositions', serving to guide people's responses in complex situations.

and to respect cultural values. Though much remains to be done, there are clear signs of institutional response in the public and the private sector, and this proves that affective and emotional reactions in public are not simply irrational but also interact with reason-based analysis [10].

However, many political stakeholders may simply ignore such efforts because they have either an interest in maintaining distrust in agricultural biotechnology or are against it for reasons of ideology or faith. Some protest organizations, which earned a lot of social capital as defenders of the public interest against agricultural biotechnology, may have a strategic interest to maintain the current strong polarization in the public debate. After all the main purpose of a protest organization is not the search for a common, political solution to specific shortcomings and abuses of power, but rather the detection and disclosure of such flaws [1]. And if there are no immediate scandals at hand, they may be artificially created through a media event, featuring a protest in front of biotechnology laboratory, for example. Within the industry, food companies and restaurant chains do not wish to risk a loss of consumers or guests because of genetically modified food. Producers of pesticides do not want to see their market shrinking (especially in developing countries) because of pesticide resistant crops. And organic agriculture is a flourishing industry that profits essentially from the negative perception of both conventional agriculture and agricultural biotechnology.

Apart from that, governments that are interested in global competitiveness may also have an interest to delay approval of imported transgenic crops in order to gain more time to develop their own products first [12] or to protect their farmers from structural change. Finally, there is a general public attitude in rich industrialized countries with a heavily subsidized agricultural sector and problems resulting from agricultural surpluses, that there is simply no need for biotechnology in their domestic agriculture. Instead they focus on the promotion of the organic agriculture as an alternative to conventional agriculture. Organic agriculture is perceived to be more 'natural' and is associated, in particular in Europe and Japan, with cultural heritage and, sometimes, an idyllic urban view of small-scale agriculture.

In short, world views, national trade interests, economic interests of political stakeholders, cultural values, personal experience, media coverage, institutional performance of regulatory agencies and psychological aspects, such as stigmatization, influence the perception of technology-related risks. The analysis of risk perception of agricultural biotechnology is therefore not anymore the exclusive field of cognitive psychology but requires knowledge about religious attitudes, international trade interests, perceptions of national sovereignty (e.g. interdependence sovereignty), the sociology of power, trust and protest organizations, and anthropological knowledge related to cultural aspects.

A better understanding of the different aspects that form the public's perception of agricultural biotechnology may help to improve understanding for certain positions and to build a new constructive dialogue that also re-introduces factual knowledge about the risks and the benefits of agricultural biotechnology.

Public perception of agricultural biotechnology in developing countries

Most studies on public perception of agricultural biotechnology have been conducted in developed countries. The public attitude in developing countries has often been neglected since it is assumed that a majority of the people in these countries is hardly informed about the advent of biotechnology. In addition, they would probably be more concerned about everyday risks rather than potential long-term risks of a new technology. Nevertheless, what we find in developing countries are elite democracies in which public opinion matters too. But it is the perception of the political stakeholders rather than the perception of the public at large that counts in public policy. In turn, these political stakeholders also depend on a certain degree of public support. In order words, they are in need of public trust to enhance their freedom of political action [13].

A large survey on public trust conducted in the 80s by Lipset and Schneider [14] in the United States showed that the public tends to trust those political stakeholders that are not considered to be driven by mere self-interest. Since the business community, the legislative and the government in developing countries are often suspected to be driven by mere self-interest, the public tends to trust those institutions that are not directly affiliated with these stakeholders such as churches, nongovernmental organizations and the academia.

But why should public interest groups and intellectuals in developing countries oppose the introduction of new Western technologies? After all, these countries have a strong desire to get access to new technologies in order to increase productivity, to relieve the pressure on environmental resources and to stimulate economic growth. An answer to this question is partly provided by an empirical survey conducted by Ortwin Renn et al. [15] on the perception of nuclear technology among technical students in Japan, Germany and the Philippines. The survey revealed that Filipino students have the most negative attitude towards this technology. A major reason for this rather counterintuitive result is seen in the fact that Filipinos regard nuclear technology as an imported Western technology with doubtful benefits and high potential risks, whereas students in Germany and Japan also associate it with cultural heritage and cheap energy supply that enhances

economic competitiveness. It indicates that a technology, which is perceived not just as an imported Western technology but also as a fruit of the country's own research and development, tends to be more accepted in developing countries. This is of particular importance with the introduction of Western technologies in agriculture since this strategy often carries the negative image of being a supply driven, top-down approach that would serve Western interests rather than resource-poor farmers in marginal areas in developing countries[3]. In fact, marginal farmers did not benefit from the green revolution to the extent farmers with favorable conditions did [16]. However, with the new tools in agricultural biotechnology it may soon be possible to tailor crops, with relatively modest research costs, that target in particular problems of farmers in marginal areas (e.g. stress-tolerant varieties, more nutritious food crops). These new crops may also help to increase productivity on existing lands and thus stop further encroachment of agriculture on pristine natural environments. This genomic revolution would be different from the previous green revolution in two ways: it would not have to rely on a few high-yielding varieties (that tend to stimulate monoculture practices in one form or another), and it would require less input costs and would therefore be less risky for resource-poor farmers. The success of such a genomic revolution, however, requires joint efforts from industry, government and non-government organizations. The common goal would be to make the technology available for research in developing country institutes, to ensure the safe introduction into the environment and its appropriate use in agriculture, and to establish appropriate marketing and infrastructure conditions for farmers.

In spite of its potential for resource-poor farmers, the introduction of agricultural biotechnology in developing countries is seen as being even more driven by corporate Western interests than it was with the green revolution. This is understandable if we consider that the public sector gradually withdrew its financial support for international agricultural research and left research on agricultural biotechnology mainly in the hands of the private sector. As a consequence, the genetically modified crops that have been commercialized hitherto are mainly designed for the large markets in industrialized countries[4].

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[3] Though the green revolution managed to increase agricultural productivity significantly in developing countries it also created environmental and health problems due to unsafe use of pesticides and chemicals. Moreover the developed high yielding varieties have been designed for farmers in favorable agricultural areas and were not inadequate for farmers in marginal areas. The lack of technical assistance and the insufficient consideration of cultural habits in marginal areas had in certain cases negative consequences on the environment and induced farmers to use there land in an unsustainable way.

[4] Though genetically improved food crops for developing countries, such as maize, sweet potato and cassava have been developed in the Centers for International Agricultural Research (CGIARs), these crops face substantial delays in the approval process.

A similar course of events took place in international development assistance where the public sector cut funding significantly in the last decade and 'outsourced' its work to non-governmental organizations. Worldwide foreign aid for agriculture has dropped by half in the last decade [17]. This trend has left a huge gap in public leadership with respect to appropriate strategies in sustainable development, the management of global public goods, and active poverty alleviation in developing countries. It also increased polarization in the public debates on the risks and benefits of globalization, and agricultural biotechnology in particular. The association of agricultural biotechnology with powerful American corporate interests is the link between the anti-globalization and the anti-biotechnology movement. A clear indication that agricultural biotechnology is opposed because of these perceived powerful corporate interests rather than the potential long-term impacts on human health and the environment can be seen in the case of Cuba. Cuba is strongly devoted to agricultural biotechnology research and has already developed its own transgenic crops and animals without facing major international or national criticism. This can be explained by the fact that Cuba's research in agricultural biotechnology is designed to ensure the country's long-term food self-sufficiency in order to remain more or less independent from the global capitalist system. That is where anti-biotechnology sentiments are no more in accordance with anti-globalization sentiments. In fact, there may be some biotechnology opponents who admire Cuba more for its independence that they would hate it for its agricultural biotechnology research. But Cuba does neither face major domestic opposition to agricultural biotechnology. And this cannot just be explained by the fact that public opinion does not count much in this country but is also related to national pride: Cuba's research in agricultural biotechnology has evolved parallel to the advances in the United States. It is largely considered to be a homegrown technology. And this confirms the assumption of Ortwin Renn's survey in the Philippines, namely that a technology, which is perceived to be a result of the country's own efforts in research and development is more accepted than a technology that is just imported from the West.

The Philippines and Mexico: A country comparison

One major problem in the global debate on agricultural biotechnology is its tendency to be reduced to a transatlantic debate. The transatlantic debate is strongly dominated by Western perceptions about the risks and benefits of this technology and how developing countries should solve their agricultural problems. Very often, stakeholders in public debates in Western countries simply pick NGO leaders or academic professors from

developing countries who fit their view or interests and invite them to speak for the developing countries as a whole. But, apart from the fact that these experts cannot represent the view of their own country, there is also a great structural heterogeneity in size, culture, history, political systems, infrastructure and economic weight among developing countries. There is not just single developing country perspective but several, each reflecting the particular social, political, economic and cultural circumstances. This can be very well illustrated by comparing Mexico and the Philippines.

The political system in the Philippines is based on an American-style presidential system. This pluralist system is characterized by a strong adversarial culture in politics, where powerful interest groups, mostly family clans, fight for political influence and scarce public resources. Personalities rather than political parties matter and political loyalty to these personalities, who are mostly powerful landlords in rural areas, is secured through a system of reciprocity within the same social class and a patron-client system between social classes [18]. In this context, the Philippines is considered to be a weak state as opposed to the Corporativist system that rules Mexico. The powerful Partido Revolucionario Institucional (PRI), the Party that lost the elections in Mexico in July 2000 after having been in power for 71 years, constructed a unique political system that looked sometimes, depending on the ruling president, either like a socialist, a fascist or a strongly neoliberal regime. This Party created an enormous social network that reached the most remote parts of the country. Gifts were often directly distributed to local communities in return for votes [19]. The PRI even created the largest public interest groups such as Unions, Farmer Organizations and Consumer Organizations, and managed to keep the political influence of the powerful Catholic Church under tight control. It now remains to be seen to what extent the new government formed by newly elected Party (Partido Acción Nacional, PAN) will or can change this strongly entrenched political culture.

From a historical and cultural point of view, both countries were colonized by the Spaniards. However, Mexico, or at that time 'New Spain', covered initially almost a third of the North American continent and was of enormous importance to the Spanish Court, whereas the Philippines was mainly a strategic post in Asia that did not receive the same attention and financial support. Furthermore, communication was difficult to maintain on such a large distance. Mexico, though involved in some wars with the United States and France, started to define its cultural and national identity already in the early 19th. The country was then mostly absorbed with itself facing dictatorship and revolution until the end of the 1920s when the predecessor Party of the PRI emerged and managed to create institutions that would endure for more than 70 years [19].

The Philippines had begun their fight for independence against Spain by the end of the 19th. In fact it was the first nationalist movement in Asia. However, the independence

fight coincided with the Spanish-American war that brought in the United States as the new colonial power. As a consequence, the independence fight continued with even more intensity and resulted in the gradual handover of political power from the Americans to the Filipinos. A 'special relationship' evolved between the United States and the Philippines that has only been interrupted through the conquest of the Philippines by the Japanese in World War II. In addition to its relationship to the US, the Philippines is also part of the Southeast Asian region, which is heavily influenced by Indian, Muslim, Malay and Chinese culture. Philippine national identity cannot be attached to any of these cultures entirely but is largely defined by the struggle of Filipinos for independence against colonial powers [20]. But the country is also divided by religion and social and economic inequality. Some attribute the structural roots of inequality in the Philippines in the country's failure to conduct a fair land reform. This is a problem that Mexico has approached more effectively, though the socioeconomic inequality is still comparable to the one in the Philippines, especially in the southern part of the country.

There is also a basic difference with regard to their major food crops, which are rice in the Philippines and corn in Mexico. Mexico started with the modernization of agriculture right after the World War II with the establishment of an agricultural research center (later called CIMMYT, the international research center for the improvement of corn and wheat) and the development of high yielding corn varieties. In the Philippines, the green revolution started later with the establishment of the International Rice Research Institute (IRRI) in the mid-1960s. While the Mexican government and CIMMYT did not always live in harmony, IRRI enjoyed great government support in the 1970s by the Marcos regime, which aimed to push agricultural modernization. IRRI is the largest institution within the System of the Centers for International Agricultural Research (CGIARs) and many Asian countries have greatly benefited from its high yielding rice varieties, however, in the Philippines, its role is discussed controversial. One reason for that might be related to IRRI's then uncritical attitude towards the corrupt and repressive Marcos regime [21]. Large Filipino non-governmental and farmer organizations that participated in the underground resistance movement against the Marcos regime still associate IRRI with an institution that co-operated with the repressive regime and represented foreign interests. The size of IRRI compared to CIMMYT may also be another important aspect. CIMMYT is one of the smaller research centers among the CGIARs in a country that is a giant in terms of GDP, population and size in Latin America. IRRI, in turn, is a giant among CGIARs in a country that belongs to the smaller nations in Asia.

Rice in the Philippines is a politically explosive issue and is greatly attached to nationalist feelings related to aspects of sovereignty and independence. Rice is highly politicized all over Asia because of its importance to food security and national [22], whereas maize in

Latin America is rather of cultural and ecological importance. Maize and its wild relatives have its origins in Mexico.

Moreover, only around 5% of the worldwide rice production is traded internationally and mainly between government agencies, whereas maize is traded in much higher quantities and less intervention, though mainly designed for feed in livestock production.

Both countries have a very rich biological diversity and are interested in a sustainable use of this asset. Whereas in the Philippines the rich biological diversity is spread all over the archipelago, Mexico's biological diversity treasure lies especially in the southern part of the country. The Philippines was one of the first developing countries that addressed the potential risk of biotechnology to biological diversity and designed biosafety guidelines already in 1991. These guidelines are still considered to be stringent, though its effective implementation is often put in doubt. Mexico has regulated biosafety using already existing regulations but is currently designing a new law on biosafety.

The opposition movements against agricultural biotechnology are quite different in Mexico and the Philippines. Most of the non-governmental organizations (NGOs) in the Philippines participated in the underground resistance movement (National Democratic Front) against the Marcos regime. Marcos'strategy for agricultural modernization was criticized to mirror his dictatorial policy as a whole, which was considered to be top-down and undemocratic. After the end of the Marcos regime, many members of civil society who participated in the underground resistance movement, decided to take an active role in the country's newly found but fragile democracy. With their multisectoral advocacy work on the local, national and even international level they became a watchdog for domestic policy issues related to women's rights, the environment, sustainable development and social justice etc. They are also focused on empowering people through their grassroots and community organizing activities [23].

Opposition against agricultural biotechnology is part of the political agenda of NGOs, which were originally opposed to the Green Revolution. Many NGOs opposing agricultural biotechnology in the Philippines express a strongly nationalist approach in their position papers arguing that the Philippines must not rely on foreign stakeholders, such as IRRI, in targeting urgent agricultural problems. Instead the country should rely on the approaches that have been domestically developed, such as alternative rice breeding and pest management, practiced by the Filipino NGOs in cooperation with the farmer community. However, within the opposition movement there are significant tensions between fundamentalist and more pragmatic NGO leaders. This may be a general weakness of the Philippines civil society movement as a whole.

In Mexico, civil society is closely associated with the Zapatistas who fight for constitutional rights for indigenous people in Chiapas in the South of Mexico. The anti-

biotechnology movement in Mexico is a more recent development than in the Philippines and is mainly led by Greenpeace and UNORCA, a large domestic farmer organization. The Mexican opposition is mainly concerned about liberalized agricultural trade within the North American Free Trade Agreement (NAFTA), which allows the importation of genetically modified corn and other food products from the United States. They also perceive an undue influence of American corporations on national regulatory agencies. Their protest focuses on unlabeled imports of genetically modified foods from the United States, the discovery of genetically modified corn in Mexican food stores and the potential ecological threat of transgenic maize to wild relatives.

Both countries, however, have also developed strong capacities in agricultural biotechnology research. Domestic research institutions such as INIFAP, CINVESTAV and the University of Chapingos in Mexico, and PCARRD, PhilRice and the University of the Philippines in Los Baños in the Philippines (UPLB) have a high reputation for outstanding agricultural research.

Methodological Approach

As mentioned earlier, the formation of an individual's perception of the risks and benefits of a new technology is a very complex process determined by the selected sources of information, values, interests, and personal experience. In the case of agricultural biotechnology, most people cannot count on personal experience but must rely entirely on the information they receive. These sources of information can be rumors, experiences of people that work in the field, statements issued by the industry, government, public interest groups or the academia, and, most important, media reports. Based on the socially communicated values, the social status, and the professional affiliation, a person regards different the sources of information to be trustworthy. The selection of sources of information is also strongly influenced by his or her personal worldview or interests.

The investigation of public perception in a particular country can be conducted by means of a representative survey where the respondents are chosen at random, or it can focus on those political actors who form public opinion and claim to represent certain public and private interests. This study uses the stakeholder approach to investigate public perception. Though, there is a risk that even the most well-meaning organizations can view the interests of their beneficiaries in a simplistic manner, or distort them unwittingly [24], this potential problem applies to all stakeholders equally. Moreover, those political actors who are actively involved in the biotechnology debate can also be assumed to be

the best informed people. This allows to conduct a survey on public risk perception in a country with low awareness of agricultural biotechnology. It also allows going beyond simple questions designed for consumers who are hardly familiar with agricultural biotechnology and its environmental, health and socioeconomic risks and benefits. Surveys in which consumers are chosen at random and asked about their perception presuppose that most respondents have already formed an opinion about the issue. However, this is hardly the case in ex-ante studies with agricultural biotechnology. The response rather reflects the latest news they received from their preferred source of information. And often they are not at all familiar with the subject but nevertheless respond in order to avoid a feeling of embarrassment for not having an opinion. These aspects may contribute to a significant distortion and a very transient character of consumer perception surveys. Therefore, it may be more appropriate to focus directly on those political stakeholders whose opinion or information serves as a relevant source of information for the public at large. An analysis of the political strategies and interests of these stakeholders may additionally give information about the long-term development of the public debate and, indirectly, of public perception of agricultural biotechnology.

In particular in developing countries with characteristics of an elite democracy and with a public that is less informed than in developed countries, it is definitely more useful to concentrate on the different political actors in the public debate on agricultural biotechnology. It can be assumed that they are well-informed and have a significant influence on those citizens who are not or hardly informed about the technology. It is correct to assume that it would helpful to know the also actual perceptions of farmers who ultimately would grow these crops and of the consumers who ultimately will eat the food in developing countries. These perception could then be compared with the perception of the stakeholders that claim to represent their interests. However such a comparison may be more useful in the future when producers and consumers in developing countries may eventually be more aware and have more personal experience with food and crops derived from genetic engineering.

The first step of such a survey on stakeholder perception is to select the political actors who represent the different stakeholders considered to be relevant in the public debate. They are selected with the help of key informants who are familiar with the political actors in the debate. Moreover, member lists of different committees related to agricultural biotechnology, and personalities often mentioned in media coverage on biotechnology are also considered.

These stakeholders were asked to fill in a semi-standardized questionnaire, which consisted of four parts. The first part was about their perception of the problems in agriculture and the potential of genetic engineering for solving these problems. The second part contained positive and negative statements regarding the potential risks and

benefits of agricultural biotechnology. The third part was about trust in institutions, and new approaches in risk reduction and legislation. The questionnaires designed for Mexico and the Philippines were not fully identical but adjusted to the national circumstances surrounding the biotechnology debate at the time the survey has been conducted. The focus of this report will be mainly on the questions and statements that were listed in both questionnaires.

The last part of both questionnaires consisted of a policy network table where around 70 organizations involved in each of the two biotechnology debates, were listed. Respondents mostly represented one of these stakeholders. Thus, they had to assess each other with regard to attitudes towards agricultural biotechnology, influence on public opinion, political decision-making and the biotechnology debate. Moreover, they had to indicate whether they think of a particular personality when they read the name of the respective organization, whether they cooperate with this organization and, if so, in what form (in terms of information, funding and directives).

The data analysis consists of a descriptive analysis of the prevailing perceptions, a cluster analysis, which presents an evaluation of different perception patterns, and a visual representation of the principal component analysis (biplot), which portrays the perception of each single stakeholder in a two-dimensional scale. Finally, the data of the policy network table is analyzed by means of a policy network analysis that reveals the influential stakeholders in the debate and the different forms of cooperation among them.

Survey results in Mexico and the Philippines

Background information

The survey in the Philippines dates back to April 1997. The study was a joint research project between the Swiss Federal Institute of Technology (ETH) and the University of the Philippines in Los Baños (UPLB) and was funded by the Swiss Development Cooperation. Altogether 65 respondents from 46 different organizations were interviewed were interviewed in the Philippines [25].

The Mexican survey has been conducted in July 2000 in cooperation with the Metropolitan Autonomous University of Mexico (UAM) and was funded by the Swiss National Science Foundation and the Hochstrasser Stiftung. In this survey 52 respondents from 41 organizations were interviewed [26]. The following illustration shows the distribution of the respondents in Mexico and the Philippines over different institutional groups.
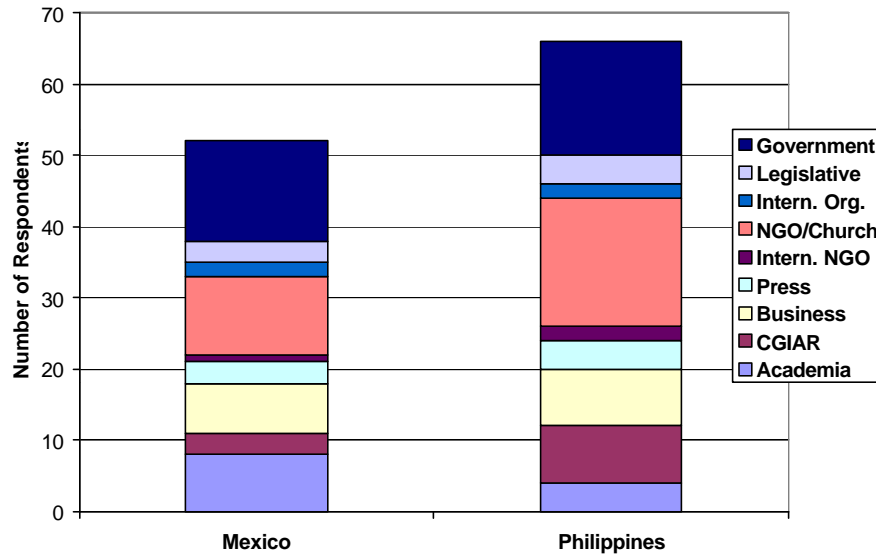
Illustration 1: Number of participants and their institutional affiliation

The organizations are broadly categorized in 8 institutional groups in both countries:

The institutional group *government* consists of high officials from government departments and agencies who are concerned with agriculture, environment, health, and trade. Respondents of *non-government organizations (NGO/Church)* included leaders from farmer-, environmental-, consumer- and biotechnology-and-society organizations, rural development foundations, churches and artists. Professors from the fields of biotechnology, ecology, social science and agriculture participated as respondents from the *academia*. Respondents from *business* represented the seed industry, the agrochemical industry, the food industry, organic agriculture companies, tissue culture companies, and restaurant chains. Apart from these four major institutional group, other respondents also represented *the Legislative, the Press, CGIARs,* and *International foundations (Intern. Org)*.

Compared to the Philippines we had relatively fewer respondents from the NGO sector. This ratio of respondents from government and non-government organizations in Mexico

and the Philippines roughly reflects the power and size of each sector in the respective country (Zapatistas in Mexico excluded). Moreover, in Mexico, the participation of the green party, the state affiliated consumer organization, restaurant chains, and the greater share of national scientists from different fields (Academia) compared to foreign biotechnology scientists (CGIARs) compensate the lower number of NGO respondents.

Descriptive Analysis

The first part in both questionnaires started with the question: *Which of the following problems in agriculture do you consider most important in your country and how do you assess the potential of genetic engineering for solving these problems*[5]?

In this context, the respondent had to assess around 20 problems in a scale from 1 to 5 whereas 1 means 'not important/no potential at all' and 5 means 'very important problem and very high potential of genetic engineering for solving the problem'.

The problems listed in Mexico and the Philippines are almost the same with the difference that the problem of Typhoon, which is relevant only in the Philippines, has been replaced in the Mexican questionnaire with problems resulting from macroeconomic and agricultural policy.

Illustration 2 shows the average perception of the respondents in the Philippines regarding the importance of the problems and the potential of genetic engineering for solving these problems.

The y-axis represents the scale from 1 to 5 and the x-axis lists the problems[6] starting from the one perceived to be most important and ending with the one perceived to be least important.

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[5] In the Philippines, the question referred to the problems in the Philippine rice economy
[6] A list of the exact formulations of the problems can be found in Annex 1 of the report
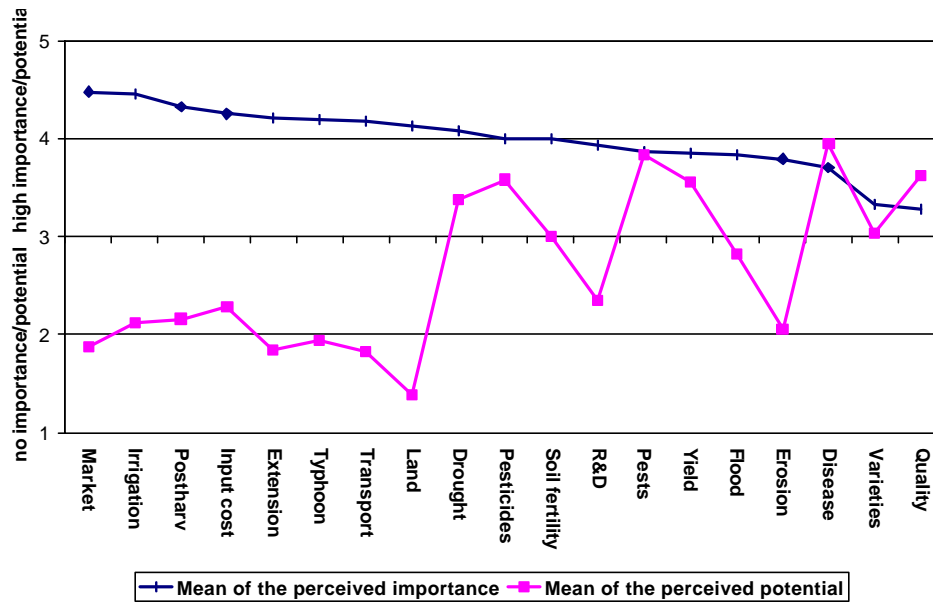
Illustration 2: Stakeholder perception of domestic problems in agriculture and the potential of genetic engineering in the Philippines

A first observation is that none of the problems in Philippine agriculture is considered to be unimportant (no problem is below the average of 3). Among the eight problems that are perceived to be most serious in Philippine agriculture six are related to structural problems[7] and the potential of genetic engineering to solve these problems is considered to be low. The first problem that is perceived to be very important and where genetic engineering is considered to have a significant potential is drought. It is also considered to have a potential with regard to other important problems such as high use of pesticides (Pesticides), pest infestation (Pests), fluctuating yield (Yield) and Plant Disease (Disease).

The situation in Mexico (see Illustration 3) looks similar with marketing, policy and infrastructure problems among the first in the list of important problems. But there is one big difference: drought is considered to be the most important problem in agriculture and genetic engineering is considered to have the potential for solving it. Other problems that are important and where genetic engineering is considered to have a potential are postharvest losses (Postharv), pest infestation (Pests), plant disease (Disease), high use of pesticides (Pesticides) and fluctuating yield (Yield). The potential of genetic engineering

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[7] structural problems include market problems (market), lack of irrigation facilities (Irrigation), postharvest losses (Postharv), lack of extension services (Extension), bad transport network (Transport), and unequal land distribution (Land).

to reduce postharvest losses is probably related to the transgenic tomato with delayed maturity, which is cultivated on a limited area in Mexico.
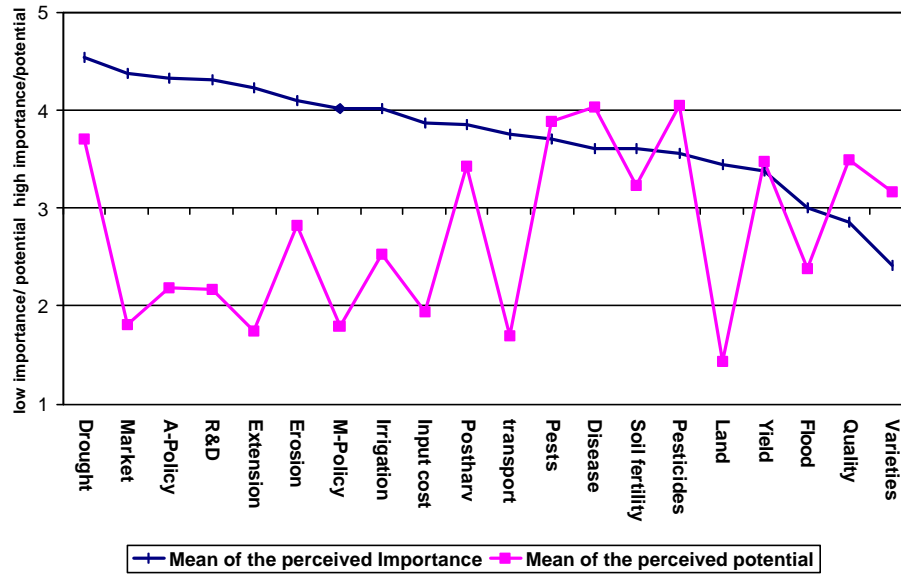

Illustration 3: Stakeholder perception of domestic problems in agriculture and the potential of genetic engineering in the Mexico

The perceived high importance of R&D in agriculture may also indicate Mexico's interest in more agricultural research. Agricultural research may refer to the development of improved pest management practices, tissue culture or genetic engineering.

The second part of the questionnaire consists of seven positively and seven negatively worded statements regarding the potential risks and benefits of genetic engineering. In both countries respondents had to indicate to what extent they agree or disagree with each of the fourteen statements again in a scale from 1 (I completely disagree) to 5 (I completely agree). The statements are based on arguments used in the actual biotechnology debates in each country.

Illustration 4 shows the eleven statements, which were listed in both surveys. Before explaining the illustration, it must be mentioned that the statement, which received most consent in Mexico, was a positive one, namely that stress-tolerant varieties will especially benefit farmers in marginal areas. The statement was not listed in the Philippine questionnaire. In the Philippines, the statement with most consent was a negative one expressing the doubt that pest-resistant crops contribute to sustainable development because of the potential of pests to break the built-in resistance of plants.

The illustration shows the scale from 1 (center) to 5 (outer angular circle). Each angle represents a positively (+) or a negatively (-) worded statements and the two lines crossing the concentric circles represent to what extent respondents in Mexico and the Philippines agreed or disagreed with the statements. The ranking starts with the statement, located at the 12:00 site (implementation), which received most consent in Mexico to the statement at 12:55 (regulation)[8] which received most dissent in Mexico. The illustration shows that in the Philippines as well as in Mexico, respondents doubt that the Biosafety guidelines can be implemented effectively (*implementation*) but they also agree that genetic engineering is '*just a new tool*' that enables to solve problems that currently cannot be solved with conventional methods. Then both countries agree that '*environmental risks*' (with respect to the potential impact of transgenic crops on biological diversity) are serious. Without going in to further details it is worth to mention that biotechnology is considered to contribute to future '*food security*' and '*health risks for consumers*' are not seen as a serious threat to consumers in both countries.
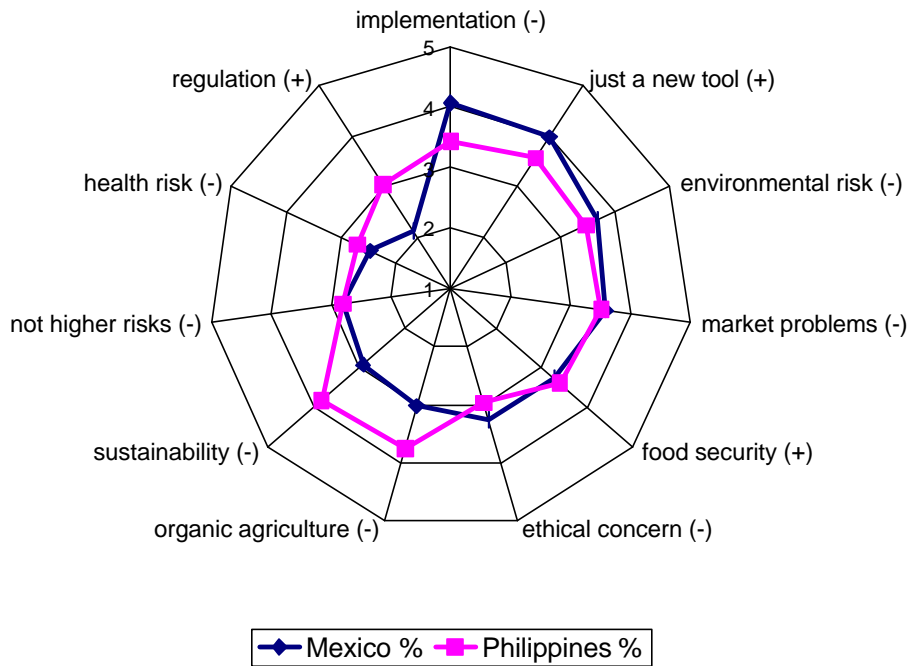
Illustration 4: Rating of the positively and negatively worded statements in Mexico and the Philippines

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[8] The exact formulation of the statements can be found in the Annex of the report

There are however, three significant differences in the perception of Mexican and Filipino respondents. Whereas the participants in the Philippines strongly agree that '*organic farming*' (in the Philippines this includes alternative plant breeding and alternative pest management) is a better strategy for resource-poor farmers to ensure their own food security, the Mexican participants seem to be indecisive in their judgment of the statement (average rating is three which means neither agree not disagree).

The same difference in perception applies to the statement that the potential of pests to break the built-in resistance of pest-resistant crops questions the '*sustainability*' of pest-resistant transgenic crops. Philippine respondents strongly agreed to this statement whereas Mexican respondents are undecided. In turn, Philippine respondents think that their biosafety regulations are rather stringent in their country whereas Mexicans think theirs are not. This can be explained by the fact that Mexico's new law on biosafety was still under construction at the time the survey has been conducted.

The statements in Part 3 of the two questionnaires were a little bit different in Mexico and the Philippines. In both surveys the questions were related to trust, legislation and communication. But whereas in the Philippines the focus was on communication, in Mexico it was on trust and legislation.

Illustration 5 shows an interesting result obtained in Mexico. The question was: to what extent do the following stakeholders enjoy confidence in public? The listed stakeholders had to be rated once again in a scale from one to five. Surprisingly CIMMYT, as a foreign stakeholder, is perceived to enjoy most confidence in public. However, if we look at the number of respondents who actually rated CIMMYT, there are only 44 out of 52. This low number somehow indicates that CIMMYT is not really seen as an important political stakeholder in Mexico. According to the results obtained in the Philippines, this is not the case with IRRI, which does not enjoy public confidence to the extent CIMMYT does.

Academia is the domestic institution in Mexico that is perceived to enjoy most confidence in public followed by public interest groups such as consumer-, nongovernmental- and producer organizations and the church.
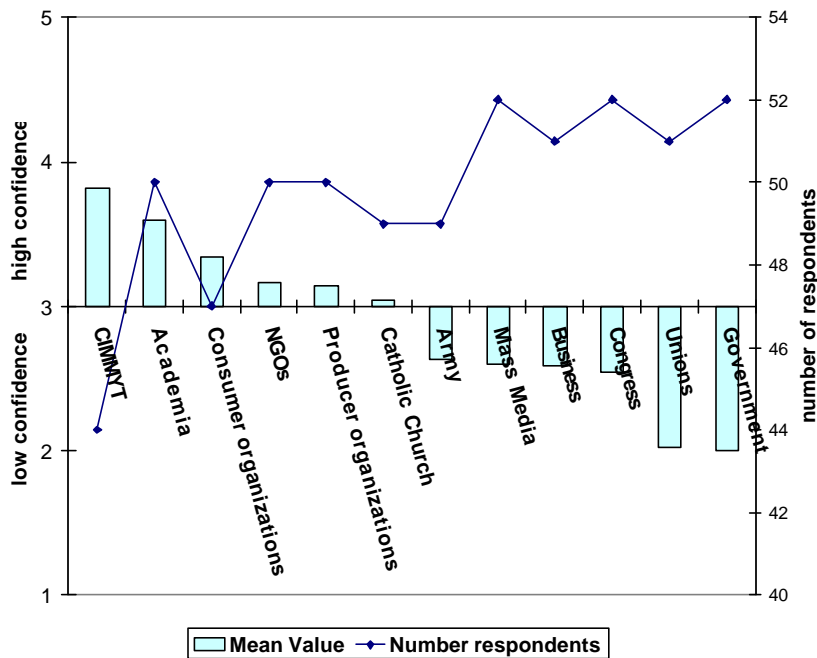
Illustration 5: Institutions and public confidence rated by Mexican stakeholders

Those who seem to suffer lowest confidence are the government, the Congress and the unions. This is not surprising if we consider that the survey has been conducted in July 2000 when the powerful PRI lost the elections for the first time but was still in power. There was a general fatigue with the old Party and its powerful grip on the government and the Congress and its pandering to the Unions. Business and the Mass Media were also perceived to have relatively low public confidence.

Distrust against the government may have benefited the favorable perception towards CIMMYT as a trustworthy foreign institution, since, the relationship between CIMMYT and the Mexican government has never been harmonious.

Perception Patterns

This part of the analysis aims at the identification of different clusters that represent perception patterns among the various political actors involved in the biotechnology debates in Mexico and the Philippines. Perception patterns regarding genetic engineering are evaluated considering the answers given in the first two parts of the questionnaire on

the potential of genetic engineering in agriculture, the potential economic impact of some transgenic products, and the perceived risks and benefits.

A number of variables were formed from the answers given in the first two parts of the Mexican and Philippine questionnaire.

Briefly, the following seven new variables were created:

(1)POTENA =   The potential of genetic engineering for solving agronomic problems

(2)POTENM =   The potential of genetic engineering for solving marketing and infrastructure problems

(3)POTENN =   The potential of genetic engineering for solving problems related to natural catastrophes

(4)POTENR =   The potential of genetic engineering for solving agrarian, policy and long-term problems

(5)POTECON[9] =   The assessment of the economic impact of six different genetically engineered food products.

(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 variables consists of statements that slightly differ in Mexico and the Philippines (compare the statements in Annex 2). One variable that is different but not explained in the descriptive analysis is POTECON, which deals with different products derived from genetic engineering[10] and its potential economic impact for the economy as a whole in the Philippines, and for resource-poor farmers in Mexico.

These variables were used to perform the three different cluster analyses (WARD, TWOSTAGE and FASTCLUS. The 65 respondents were allocated according to their institutional membership. Thus, the following thirteen institutions were formed:

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[9] In Mexico the question is referred to the economic potential for resource-poor farmers whereas in the Philippines it is referred to the potential for the domestic economy as a whole.

[10] The products listed in the Philippines were: Bt rice, Banana with increased shelf-life, rBST milk, GM microorganisms transforming corn into sugar substitutes, Coconut with higher oil content, herbicide resistant soy bean. In Mexico the products were: Virus resistant potato, Bt maize, Vitamin A rice, transgenic cattle vaccine, herbicide resistant soy bean, rBST milk, Bt cotton, Tomato with delayed maturity.

A	= Academia			G	= Government (Dep.ts and Agencies)	
B	= Business			L	= Legislative	
M	= Press			N	= NGOs, Churches, Farmer- and	
I	= International organizations				Consumer Organizations	
IN	= International NGOs					

In the Philippines the three different procedures yielded almost the same three perception groups, whereas in Mexico only the WARD clustering method yielded reasonable results. The following table (Table 1) shows the three perception groups obtained with the WARD procedure in Mexico and the Philippines:

Philippines	A	B	M	I	IN	G	L	N	TOTAL
Cluster 1	1	1	2	1	2	1	0	13	21
Cluster 2	2	2	1	2	0	10	4	3	23
Cluster 3	2	5	0	6	0	4	0	1	18
									65

Mexico	A	B	M	I	IN	G	L	N	TOTAL
Cluster 1	3	0	1	0	1	3	1	6	15
Cluster 2	4	5	0	3	0	8	2	2	24
Cluster 3	1	2	2	2	0	2	0	2	11
									50

Table 1: Results of the WARD clustering procedure in Mexico and the Philippines

In the Philippines, Cluster 1 mainly consists of representatives of international (2) and national (13) nongovernmental organizations (including churches, farmer organizations, and consumer organizations). Cluster 2 is dominated by representatives of the government (10) and the legislative (4). And Cluster three contains predominantly representatives from Academia (4), Business (6), and international organizations (5). The representatives of this third group are mainly scientists from private and public research institutes.

Whereas in the Philippines the institutional groups can be clearly attributed to a certain perception pattern (cluster), this is not the case in Mexico. Cluster 1 in Mexico is also dominated by nongovernmental organizations (7 altogether), but there are also quite a few representatives from governmental agencies (3) and the Academia (3). Cluster 2 is the largest perception group and consists mainly of politicians from the Legislative (2), representatives from government (8) and non-government (2) organizations, and scientists from academia (4), business (5) and international organizations (3). Cluster 3 is the smallest perception group but contains respondents from all the different institutional groups with the exception of international NGOs and the Legislative). This wide range of

stakeholder representatives in each cluster indicates that the perception of agricultural biotechnology differs significantly even within institutional groups in Mexico.

The Biplot graph is based on a principal component analysis and provides a two-dimensional, unclustered picture of the variables (vectors[11]) and observations (letters). The dimensional illustration of the different individual perceptions. This enables to identify the clusters in an unclustered presentation, and to single out the perception of each respondent by its location and its distance to the different vector variables.

In the Philippines, the perception patterns built using the cluster analysis are also clearly visible in the Biplot (see Illustration 6).
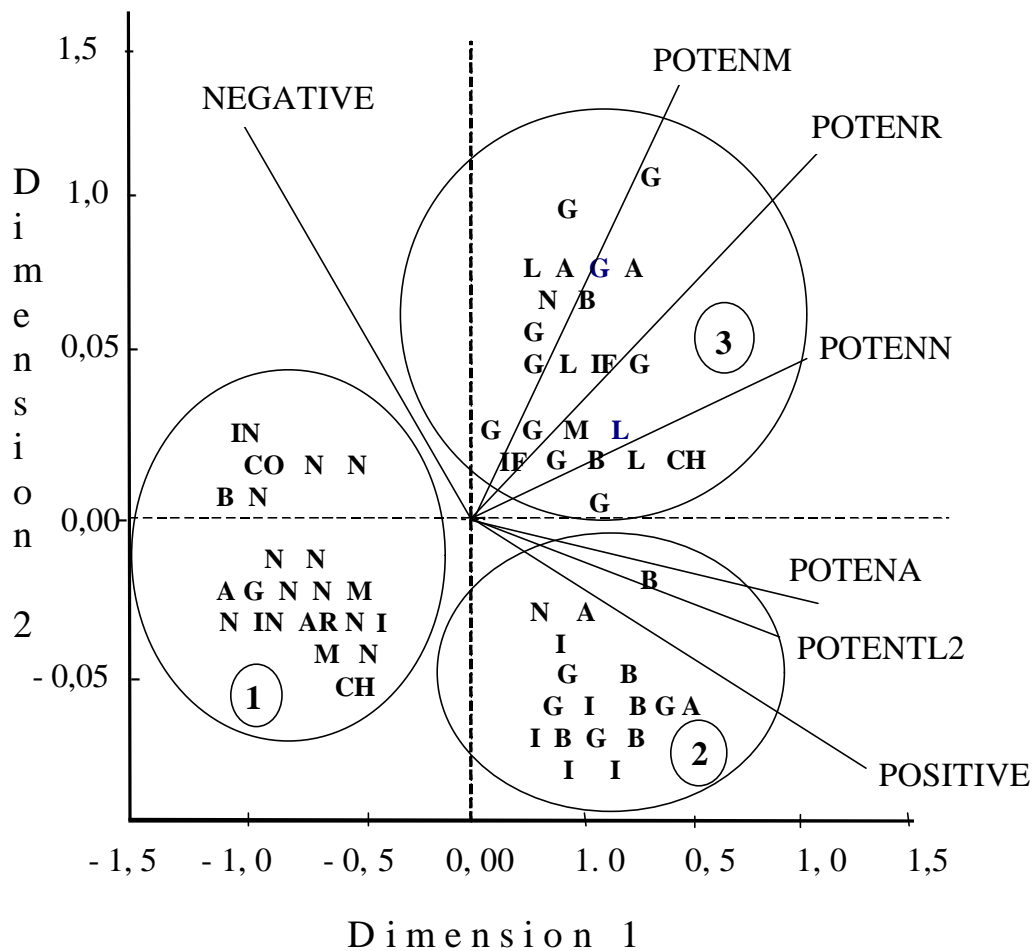

Illustration 6: Biplot of the perception of agricultural biotechnology in the Philippines

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[11] The length of the vector represents the Eigenvalue of the variable (explanatory power).

We see in illustration 6 that most NGOs (N) in cluster 1 disagree with the positively worded statements (POSITIVE) and agree with the negatively worded statements (NEGATIVE) and they don't see any significant potential of agricultural biotechnology to solve problems in Philippine agriculture (POTENM-,N-,A). Within this group we also have a representative from business (B), representing the organic farming business, from a consumer organization (CO) and the Church (CH), representing the protestant church. Though we find also one respondent from IRRI (I) in this group, the major part of the scientists working in public (G, A, I) and private (B) research institutes are found in the Cluster 2. This perception group presented by Cluster 2 agrees strongly with the positively worded statements and sees a significant economic potential of agricultural biotechnology products (POTECON) and considerable potentials regarding agronomic problems (POTENA) and natural stresses (POTENN) in rice agriculture. The third perception group (Cluster 3) with respondents mainly representing government (G), the legislative (L) and international foundations (IF) considers biotechnology to have a very high potential for solving problems in Philippine agriculture (POTENM, POTENN, POTENA) but have an ambivalent attitude towards the risks and benefits involved (POSITIVE, NEGATIVE) for one half tends to agree with the positively worded statements while the other half tends to support the negative ones. The ambivalent attitude of policy makers reflects a particular Filipino dilemma: On the one hand, policy makers acknowledge the important work of NGOs in rural development and alternative pest management practices, and are interested in having the political support of the large NGO networks. On the other hand, they are aware of the importance of science and technology in agriculture and want to promote agricultural biotechnology, in particular because of the already existing skills in agricultural biotechnology research in the Philippines. Interesting is also the different perception of the churches (CH) in the Philippines: whereas the respondent of protestant church, found in Cluster 1, seems to have a rather negative attitude, the one representing the Catholic Church seems to share a more pragmatic attitude with the respondents in Cluster 3.

The Biplot for Mexico (see Illustration 7) shows that the three Mexican perceptions groups form less distinguishable clusters, compared to those in the Philippines.

Cluster 1 represents the perception group, which can most clearly be separated from the remaining respondents. Respondents represent mostly NGOs, but also some Academic and Government institutions. The three government respondents in this group represent agencies concerned with biosafety and the environment. Their general attitude towards agricultural biotechnology tends to be critical. The group agrees with most negative statements and disagrees with most positive statements and, apart from the economic potential (POTECON), it does not see any potential for genetic engineering to solve problems in Mexican agriculture.

Respondents in Cluster 2, the largest of the three perception groups, appear to have a more balanced view that tends towards a more positive attitude about agricultural biotechnology. This perception of the group consisting mainly of policy makers (G, L), scientists (A, I) and business representatives (B) ranges from a very favorable to a slightly skeptical attitude. The group generally recognizes the economic potential (POTECON) also for resource poor farmers in Mexico. They also believe in the biotechnology's potential to help solving agronomic problems (POTENA) and problems resulting from natural catastrophes, such as drought and flood (POTENN). The perception of the respondent from the Catholic Church is also identified as a member of Cluster 2 and, thus, shares a similar perception with its counterpart in the Philippines.

Cluster 3 consists of the smallest number of respondents representing almost all institutional groups. These respondents tend to have the most favorable attitude towards genetic engineering. They strongly endorse the positively worded statements and emphasize the high potential of biotechnology for all the different categories of problems in Mexican agriculture.

As the Biplot indicates, Cluster 2 and 3 can less clearly be separated from each other. Although the clusters 2 and 3 are closer, the probability test (Prob>Mahalanobis Distance, see Annex 3) showed that there is a significant statistical difference between the two clusters.

A major difference between Mexico and the Philippines is that NGO representatives, scientists and policy makers, the most important actors in the biotechnology debate, are clearly separated by perception groups in the Philippines whereas in Mexico they are scattered all over the three perception groups. In Mexico, the majority of the respondents are located in the center of the illustration with a slight tendency towards a positive attitude, whereas the respondents with a clearly negative or a clearly positive attitude (cluster 1 and 2) are more widely scattered. In the Philippines respondents concentrate clearly in clusters that tend to be far from the center. It indicates that there is more polarization among the political stakeholders in the debate in the Philippines.
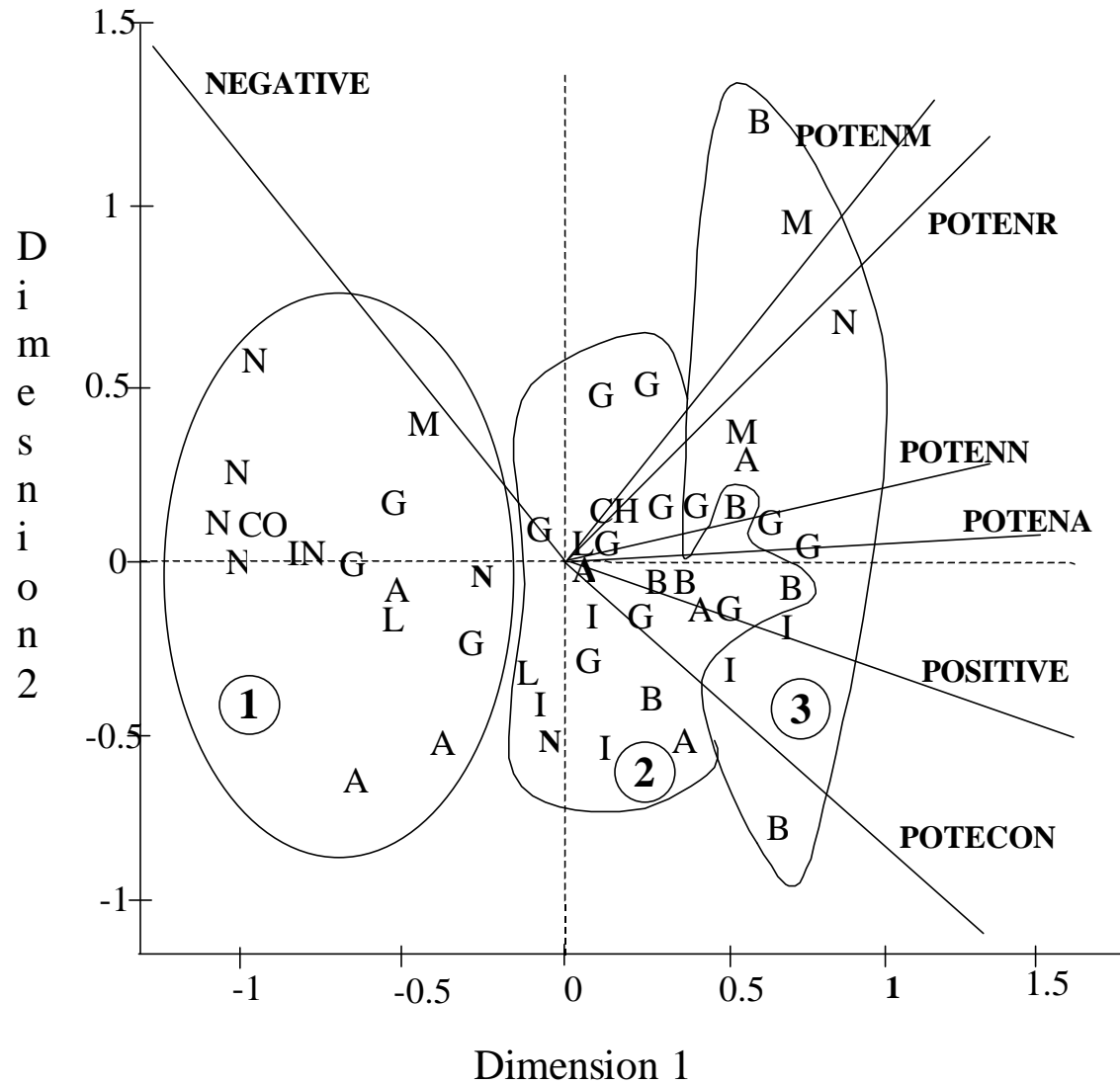
Illustration 7: Biplot of the perception of agricultural biotechnology in Mexico

Stakeholder cooperation and influence

The goal of the policy network analysis is to investigate existing networks of cooperation among political actors and identity those actors who are considered influential in the political debate on biotechnology in Mexico and the Philippines. The data necessary for this analysis was obtained in part 4 of the questionnaire where respondents were asked to

assess the organizations listed in the policy network table. These organizations represent the important political stakeholders from institutional groups such as the academia, artists, business, churches, consumer organizations, the mass media, international organizations, government agencies, government departments, the legislative, the military, environmental and farmer organizations, and unions. The list contains 65 organizations in the Philippines and 72 in Mexico. Most of these organizations were represented by at least one respondent in the survey. Respondents were asked to answer 5 questions with respect to each of the organizations listed. The possible pre-structured answers were labeled as numbers or letters, which then had to be inserted into the respective cell in the table.

The first question was: *Do you know this stakeholder?* The respondent had to answer the question either by inserting a 0 (No) or a 1(Yes) into the respective cell of the column which was designed for the answer of the question and the row of the respective organization.

Illustration 8 shows the average frequency with which the various organizations within their respective institutional groups were mentioned in the policy network table in the Philippine and Mexican survey. The calculation of the average number of references was performed by adding the number of references for each organization within an institution group and dividing it by the number of organizations within the institutional group. The illustration presents average percentage shares of the number of times organizations within different institutional groups were mentioned.

One important difference is that Filipino Artists, Consumer organizations and national nongovernmental organizations are more mentioned in percentage than their Mexican counterparts, whereas international organizations and international NGOs, Academia and the Mass Media are more mentioned in Mexico. It indicates a bigger involvement of the civil society in the biotechnology debate in the Philippines.
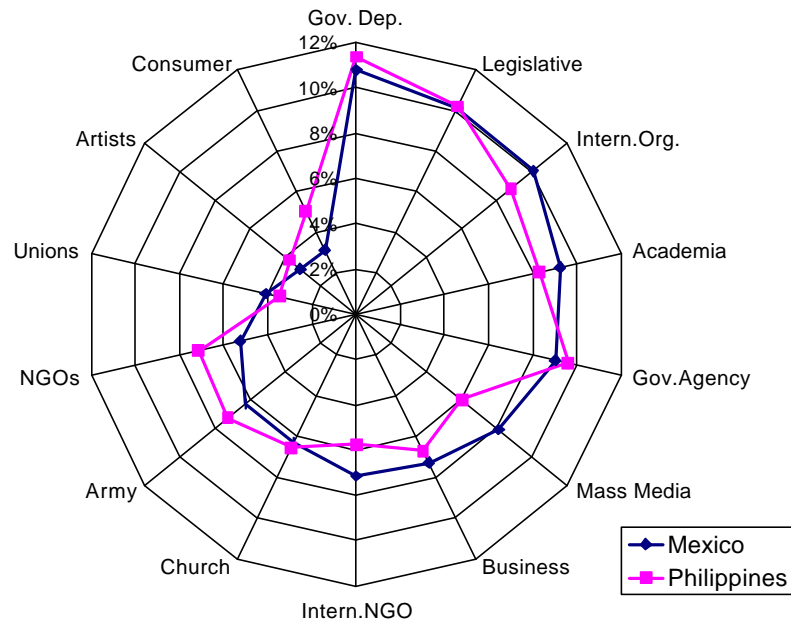
Illustration 8: Most mentioned institutional groups in Mexico and the Philippines

The second question was: *What do you think is the stakeholders' attitude towards biotechnology?*

Illustration 9 shows the assessed average attitude (in percentage) attributed to the different institutional groups. The respondent had to rate the respective organizations using a scale from 1 to 3 (1=negative, 2=neutral, 3=positive). The higher the percentage share, the more positive the attitude.

In both countries, international organizations (including CGIARs) are considered to have the most positive attitude towards agricultural biotechnology, with much emphasis in the Philippines. Whereas Academia, government agencies and government departments are considered to have a slightly more positive attitude in the Philippines than in Mexico, public interest groups such as national and international NGOs, Churches, Consumer organizations are felt to have a more negative attitude in the Philippines. The rather moderate negative attitude of NGOs assessed by the Mexican respondents may indicate a greater diversity of opinions and interests among Mexican NGOs compared to Philippine NGOs.
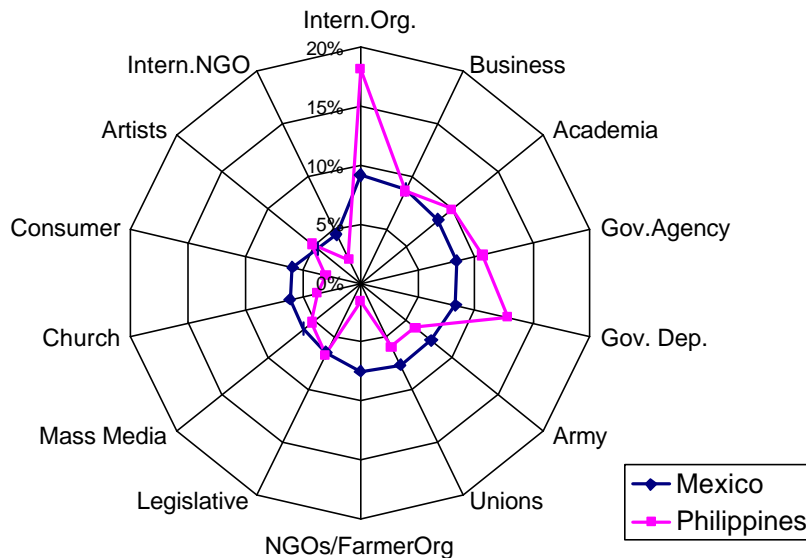
Illustration 9: Assessed attitude towards agricultural biotechnology in Mexico and the Philippines

The third question which had to be answered for each organization was *the perceived influence on political decision making processes, public opinion, the debate on genetic engineering in agriculture, and the debate on genetic engineering in general*.

Illustration 10 shows how the different stakeholders assessed each other mutually with regard to their influence on political decision-making processes in the Philippines and Mexico. Once again, percentage shares were used to facilitate a comparison between the two countries. Government departments and the legislative are considered to be most important with regard to political decision making processes in both countries. However, this is again much more emphasized in the Philippines where the government (Gov. Dep., Gov. Agency) and the legislative obtained 55% of the points attributed to all the different stakeholders. It may indicate that there is a higher concentration of political decision making power in the Philippines.

The influence of unions, the mass media and nongovernmental organizations on political decision making processes is considered to be higher in Mexico. This may be explained with the PRI-shaped corporativist system in Mexico. This political system used a rather

consensus-oriented policy approach in which public interest groups (though certainly not all of them) were involved in advance in the design of political strategies.
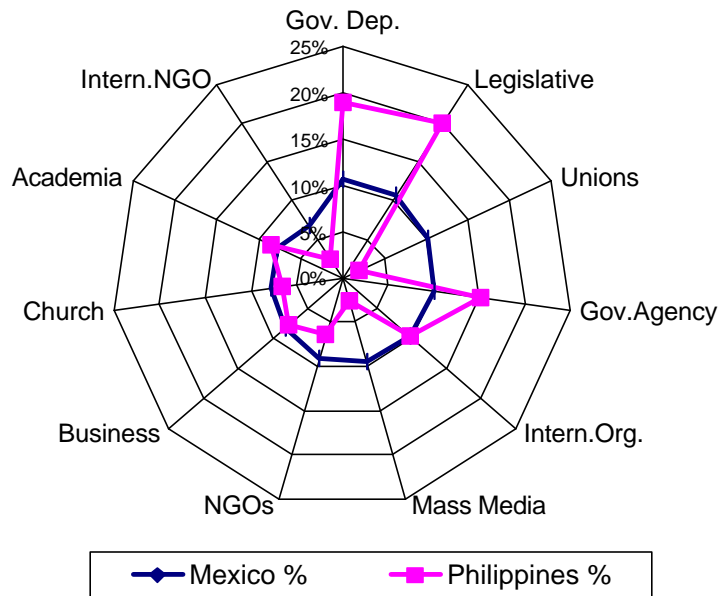
Illustration 10: The assessed influence on political decision making processes

Illustration 11 presents the mutual assessment with regard to influence on public opinion:

In both countries the Church is considered to be the most important opinion leader. This again is more pronounced in the Philippines (where the Church is also felt to have more influence on political decision making processes). NGOs and the mass media are perceived to have more influence on public opinion in the Philippines whereas Unions, Business and international organizations are felt to be more influential in Mexico. The legislative and in particular the government don't appear to have any significant influence on public opinion in Mexico. This may be explained by the time the survey has been conducted; in July 2000, the powerful PRI lost the elections for the first time in 71 years, but was still allowed to rule until the end of the year. As mentioned earlier, there was a general fatigue with the government and the legislative, which were both still in the hands of the PRI. Historically, the PRI did not appear to care a lot about public opinion. It preferred secured favorable public opinion by doing favors to public opinion leaders. PRI politics has often been criticized for being not enough transparent to the public [19]
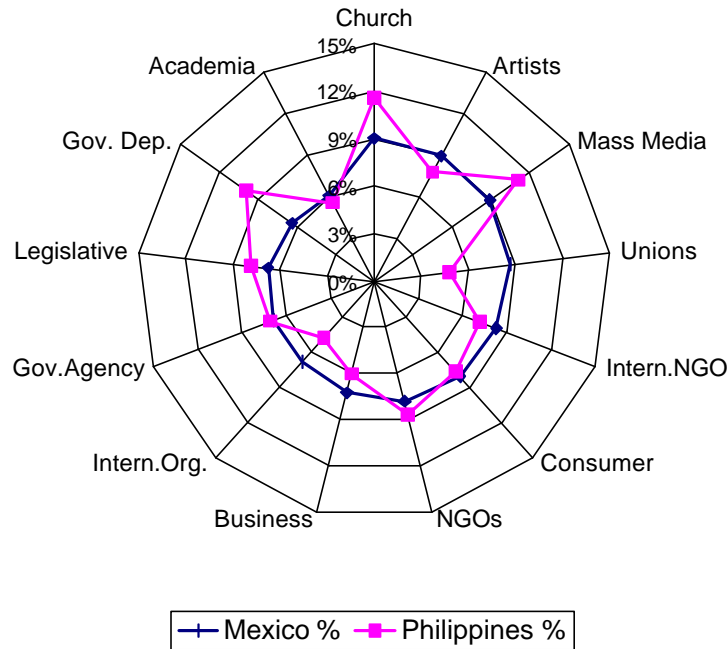
Illustration 11: Assessed Influence on Public Opinion

Illustration 12 portrays the perceived importance in the debate on agricultural biotechnology.

In both countries Academia is considered to be the leader in the public debate on agricultural biotechnology, and NGOs, business and international organizations are considered to be influential in both countries. International organizations seem to play a higher stake in the Philippines because of IRRI as a key foreign stakeholder in the country, whereas the dominance of Greenpeace in the Mexican debate may explain the slightly higher influence of international NGOs in Mexico. The government seems to play a minor role in Mexico but not in the Philippines. In turn, the mass media appears to be more involved in Mexico than in the Philippines. In both countries the role of the Church is perceived marginal in the agricultural biotechnology debate.
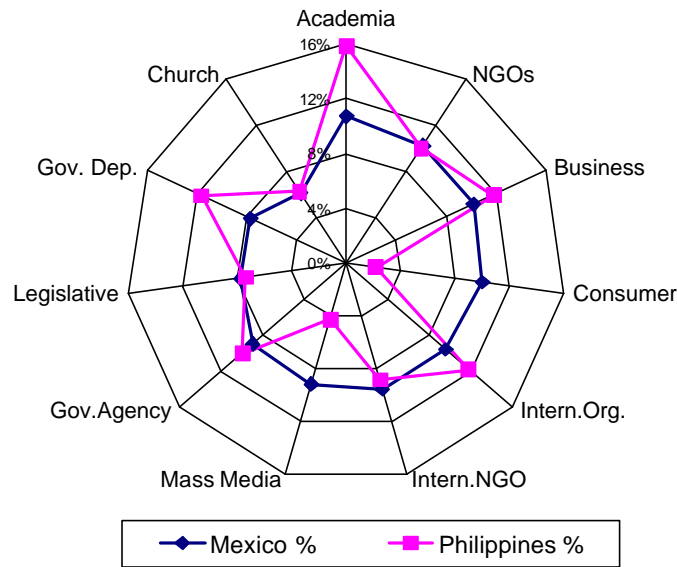
Illustration 12: Assessed influence on the debate on agricultural biotechnology

The third question, which had to be answered for all the organizations was whether the respondent associates a certain personality with the organization. The purpose of this question was to find how dominant personalities are perceived compared to organizations and how the most mentioned personalities are distributed over the different institutional groups.

This question showed that dominant personalities play a particular dominant role in the Philippines where they are often better known than the organization they represent. Comparing the distribution of the 15 most mentioned personalities over the different institutional groups, it turned out that most of the personalities concentrate in government (9) and non-government (4) organizations in the Philippines, whereas in Mexico the distribution was more evenly distributed with 6 personalities from government, 3 from Academia and the rest scattered over 5 different other stakeholders. This result confirms the assumption that Filipino politics is dominated by strong personalities within politics [18] and among NGOs [23].

Cooperation Networks

The last column of the policy network table was designed for respondents to indicate whether they cooperate with the respective organization, and if yes, it what way (giving and/or receiving information, directives, financial support).

The evaluation of the cooperation networks concentrates on different forms of cooperation, such as financial support, information exchange, and the directives. To create a policy network, it is sufficient if at least half of the respondents completed this rather demanding part of questionnaire. This has been the case in both countries.

Using the software program Krackplot, six networks have been created (giving information, receiving information, giving financial support, receiving financial support, giving directives, receiving directives). By combining the giving and receiving networks, three new networks were created representing the most influential actors in terms of information exchange, financial support and directives. Instead of presenting the illustration of each single network the following section describes the main findings drawn from the networks.

The information exchange network obtained in the analysis in Mexico indicates the important role played by AgroBio, an important discussion forum formed by the industry, and CAMBIOTEC and BIODEM (two non-governmental organizations that are dedicated to the investigation of the potential socioeconomic impacts of biotechnology) as hubs of information exchange. These three organizations are all affiliated with one very active personality in the Mexican debate, who was also the most mentioned personality in survey. The most important receiver of information is CIBIOGEM, the intersecretarial committee on genetically modified organisms, which has been set up in 1999 to deal with biotechnology across the different government departments, and the legislative. The most important givers of information are several academic and government research institutions, national and international non-governmental organizations. The important role of international non-governmental organizations as information distributors is due to the very active role of Greenpeace.

Many of the central actors in the information network also appear again in the network of financial support in Mexico. But international organizations, which did not show up in the information network (with the exception of CIMMYT, which is an important source of information) are now playing the most important role as donors. The Interamerican Development Bank (BID) and the Rockefeller Foundation are playing a crucial role in supporting research institutes in government and academia, CIMMYT, committees on biosafety, and NGOs concerned with environment and rural development. The most important national player in terms of financial support is CONACYT, the government

agency that is concerned with Culture, Science and Technology. CONACYT focuses its support almost entirely on research conducted at national universities. Grants are not just given to natural sciences research institutes but also to social science research concerned with the implications of biotechnology on society and development. Major receivers of financial support are the organizations and committees concerned with biosafety (CIBIOGEM, CONABIO, Consejo consecutivo de bioseguridad).

An NGO called Fondo Mexicano para la Conservación de la Naturaleza, appears to serve as one of the hubs for the distribution of financial support. It receives financial support from government and international organizations and gives support to research projects conducted in government and academia related to the environmental conservation.

In the network of directives in Mexico organizations and committees concerned with biosafety belong to those who receive most directives. Other important receivers of directives are research institutes concerned with biotechnology, AgroBio, the Food industry, and the national farmer confederation (CNC). The most important givers of information are the department of Agriculture, the former National Committee on agricultural biosafety (CNBA) and the legislative (Congress and Senate).

The agricultural university of Chapingos appears to be a major receiver and giver of directives. NGOs and International organizations appear to play a marginal role in the network of directives.

In the Philippines the networks show some similarity with the networks in Mexico: Academia and NGOs play an important role as information dispensers, International donors also play a crucial role in the financial network (Rockefeller Foundation, Asian Development Bank), and the legislative, government departments and committees on biosafety and sustainable development play a crucial role in the network of directives.

However, NGOs' links to Academia, the legislative and the mass media is much more emphasized in the information network in the Philippines. NGOs in the Philippines mostly receive information from Academia, create then a position paper and send it to the mass media and the legislative. This role of NGOs as a hub of information distribution is certainly not absent in Mexico but obviously seen as less dominant by Mexican respondents. Filipino NGOs show almost complete financial independence from government while Mexican NGOs receive funds from several government agencies. In the network of directives Filipino NGOs don't receive any directives neither from the government nor from non-government organizations, whereas in Mexico this is not the case.

The significant role of Filipino NGOs in the information network and their independence from directives and government financial support seems to be the major difference in the cooperation networks in the Philippines and Mexico.

Conclusions

The aim of the overall research project was to understand the knowledge, the perceptions and the interests that shape the debates on agricultural biotechnology in developing countries. The two surveys conducted in Philippines and Mexico indicate that the expectations and concerns related to agricultural biotechnology are different from those prevailing in developed countries. Moreover, a comparison of the stakeholder perception in Mexico and the Philippines shows that the political, cultural and historical backgrounds are considerably influencing the issues that are discussed in the national biotechnology debates.

Survey results showed that respondents in the Mexican case study believe drought to be the most serious problem in agriculture and expect genetic engineering to help solving this problem with the development drought-tolerant varieties. These drought tolerant varieties are also felt to benefit especially farmers in marginal regions. Though drought is also seen as an important problem in the Philippines and agricultural biotechnology is also seen as having the potential for solving it, Filipino respondents see the most urgent problems in agriculture in marketing and infrastructure problems.

Respondents in both countries are concerned about the effective implementation of biosafety guidelines and the potential environmental risks cultivating transgenic crops. Mexican stakeholders are particularly concerned about the potential of transgenic maize to outcross with local indigenous maize varieties, while their counterparts in the Philippines are worried about the effects of pest-resistant rice on non-target organisms. However, participants in both surveys mainly disagree with the statement that genetically modified food poses a health risk and agree that genetic engineering is a powerful tool to solve problems in agriculture and may help to ensure future food security. Besides the importance of drought, respondents in both countries consider genetic engineering to have the potential to solve other important problems such as pest infestation, plant disease and high use of pesticides.

The respondents in the Philippines tend to see to organic farming methods, as developed and used by Filipino NGOs and farmers, a better strategy for resource-poor farmers to ensure their own food security whereas the Mexicans don't share this perception. Moreover, Filipino respondents question the sustainability of Bt crops because of the potential of pests to break the built-in resistance, whereas their Mexican counterparts are more reluctant to regard this risk as reason for questioning the sustainability of Bt crops.

In turn, biosafety regulations are considered to be insufficient in Mexico whereas in the Philippines, people seem to regard their regulations as sufficiently stringent. This may be explained by the fact that Mexico relied for a long time on existing laws to regulate agricultural biotechnology and is only now designing a new law on biosafety.

The survey also showed that Mexican stakeholders tend trust CIMMYT (the International Maize and Wheat Improvement Center) more than Filipino stakeholders trust IRRI (the International Rice Research Institute). IRRI's size (compared to CIMMYT), its historical background in the Philippines, and the controversial the discussion of the green revolution in the Philippines may be reasons for this difference.

The cluster analysis yielded three different perception patterns in Mexico and the Philippines. The cluster analysis in the Philippines produced three clear perceptions patterns. It showed that NGOs and other public interest groups mainly oppose agricultural biotechnology and don't see any potential for genetic engineering to solve problems in agriculture. In turn, scientists of private and public research institutes in the second perception group appear to have a positive attitude and believe in the potential of genetic engineering to solve at least problems resulting from pests, viruses and stress exposure. Government officials and politicians, who form the third perception group in the Philippines, expect biotechnology to have a great potential to solve problems in agriculture but have an ambiguous attitude toward the potential risks and benefits of genetic engineering in agriculture.

In the Mexican survey, the first perception group tends to have a negative attitude towards biotechnology, similar to the first group in the Philippines. But it is not just formed by NGOs and other public interest groups but also includes some governmental agencies that are concerned with biosafety and environmental issues and a few professors from national universities. The second and the third perception group are very close together and contain 70% of the respondents. The second group is the largest and consists of scientists, government officials, politicians and representatives of NGOs, business and international organizations. The group tends to be in favor of agricultural biotechnology but also contains a few respondents with a slightly critical attitude, and, generally, believes in the potential of genetic engineering to solve problems in agriculture ranging from agronomic and post-harvest problems to problems caused by exposure to natural stresses. The third perception group tends to be more strongly in favor of agricultural biotechnology. It consists again of respondents from all different institutional groups.

Whereas most respondents in Mexico are located in a moderate position in the perception scale, respondents in the Philippines tend to be found more in the outer regions. It indicates that there is a stronger polarization in the Philippines, whereas in the Mexican debate positions seem to be less hardened. In both countries there seems to be a

significant perception gap within government departments: whereas agencies affiliated with the department of environment tend to be critical, agencies related to the department of trade, agriculture and science and technology tend to be in favor of agricultural biotechnology.

Though the Philippine survey has been conducted in 1997, before the great European fear, and the Mexico one only in 2000, it appears that the debate in the Philippines was then already more polarized than the debate in Mexico three years later. This might be related to the pluralist political system in the Philippines, which is characterized by a strong adversarial culture in politics. The policy network analysis also indicated that NGOs and the mass media are perceived to be more influential on public opinion in the Philippines whereas in Mexico they are seen as important stakeholders in the political decision-making process. Public opinion did not count as much in Mexico's One-Party corporativist system as it does in pluralist system of the Philippines. In turn, public interest groups seem to be more incorporated into the political decision making processes in Mexico than in the Philippines, where these groups prefer to influence political decisions through public pressure created by media campaigns. In Mexico, unions seem to enjoy significantly more influence on public opinion and political decision making processes than in the Philippines, but at the same time they face very low public trust because they are associated the former government and Congress who were also considered to face low public confidence. In both countries, Academia seems to be the central stakeholder in the agricultural biotechnology debate. In Mexico the stake of social scientists seems to be higher in the biotechnology debate than in the Philippines.

The analysis of the cooperation networks show that many NGOs in the Philippines play crucial role in the acquisition and dissemination of information, using the national universities as the main sources of information and sending information to the legislative and the mass media in form of position papers. In Mexico, stakeholders from different institutional groups appear to share the role that has been assumed by NGOs in the Philippines. Filipino NGOs also prove to be almost completely independent from government funding whereas in Mexico there seems to be a much stronger cooperation between government and NGOs. Personalities play an important role in the public debate in both countries, though they are more widely distributed over the different institutional groups in Mexico. Dominant personalities in the Philippines are concentrated in government and non-government organizations. Among the Filipino respondents, these personalities often appear to be better known than the organizations they represent.

In both countries academic institutions are the most important distributors of information, are central in the public debate on agricultural biotechnology and enjoy high public confidence. The role of the Academia may play crucial role to facilitate a constructive dialogue between the more antagonistic stakeholders. Though a majority of the

respondents in academia seems to have a favorable attitude towards agricultural biotechnology, they are not just found in one single perception group but in all of the three.

The fact that there are professors who have a critical attitude towards agricultural biotechnology might be related to the fact that they don't consider it to be a technology that is the fruit of domestic research and development but rather an imported technology from the West. This is in particular the case in Philippines, where many national scientists involved in biotechnology research tend to be more in involved with international research centers and multinational corporations than with the national academia. In turn, other national professors in agronomy, social sciences and ecology are strongly involved with Filipino NGOs in research and development of alternative rice breeding and pest management programs. This NGO-research approach is considered to be homegrown, and therefore appeal to nationalist feelings, which often play a major role in the Filipino debate. For example opponents often argue that the Philippines must not rely on foreign technology, mainly referring to IRRI, but take advantage of its domestically developed approaches. Such an alternative approach practiced as successfully as in the Philippines, does not exist in Mexico. Moreover, it is the domestic biotechnology research at CINVESTAV and INIFAP that is discussed publicly in Mexico and not the one at CIMMYT.

Both countries would have the capacities and the infrastructure to develop their own bioengineered crops designed for domestic needs and exportation. But Western countries need to encourage these efforts with financial assistance and less market protection. Otherwise, countries, such as the Philippines and Mexico may feel discouraged in their efforts to catch up in this very important new research field. As a consequence the technology itself will become less accepted in these countries considering it as just another imported Western technology. This development would be fatal since, once more, developing countries would be shut out in the early development of a key technology. A global system of governance of biotechnology has to take into account the particular perceptions in developing countries. It is not just the appropriate management of the risks involved but also the fair and equitable distribution of the benefits. It is of crucial importance for developing countries to have the capacity to conduct their own research and development in agricultural biotechnology to address their particular agricultural problems, and to become less dependent on Western imports and more competitive in a globalized economy.

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Annex 1

Agricultural problems listed in the questionnaires in Mexico and the Philippines:

Label	Philippines	Mexico
Drought	drought	drought
Flood	flood	flood
Yield	fluctuating yield	fluctuating yield
Pesticides	high use of pesticides	high use of pesticides
Postharv	inadequacy of postharvest facilities	inadequacy of postharvest facilities
Input	indebtedness of farmers due to high input costs	indebtedness of farmers due to high input costs
transport	inefficient transport network	inefficient transport network
Irrigation	insufficient irrigation facilities	insufficient irrigation facilities
Market	market conditions (low prices, cartels importation, etc)	market conditions (low prices, cartels importation, etc)
Pests	pest infestation	pest infestation
Disease	plant diseases	plant diseases
Quality	poor eating quality	poor eating quality
Soil Fertility	reduced soil fertility	reduced soil fertility
Varieties	small number of varieties	small number of varieties
Erosion	soil erosion	soil erosion
R&D	too little investment in R&D	too little investment in R&D
Typhoon	typhoon	
Land	unequal land distribution	unequal land distribution
Extension	weak support services (extension, technical assistance, research, credit)	weak support services (extension, technical assistance, research, credit)
M-Policy		Macroeconomic Policy
A-Policy		Agricultural Policy

Annex 2

The common positive and negative statements listed in the Philippine and Mexican survey

Label	Philippines / Mexico
not higher risk for farmers	Genetically engineered varieties do not present higher risks for farmers than conventionally bred varieties
health risk is serious	Bt Rice/Transgenic Potato poses a health risk for consumers
food supply in Asia	Genetically engineered rice/corn could help to ensure future food supply in Asia/Latin America
sustainability	The potential of stem borers to overcome the built-in resistance of Bt Rice/Corn questions sustainability
organic farming	Alternative Pest Management (APM)/ Organic Agriculture is a better strategy for enabling resource-poor farmers to ensure their own food supply
just a new tool	Genetic engineering in agriculture is a new tool that enables breeders to solve problems that currently cannot be solved by traditional breeding methods
market inefficiencies	Because of an inefficient marketing system, ...Rice Producers won't profit from genetic engineering through hihger revenues nor will consumers from lower prices / ...Farmers in marginal areas won't benefit from transgenic crops
ethical/rel. problem	Genetic engineering …in agriculture poses an ethical problem for religious people / …represents a serious ethical problem
environmental risk	There is a potential ecological risk involved, because ….Bt Rice will also affect non-target organisms / ….transgenic maize may outcross spontaneously with wild or or conventional rice and will therefore affect biodiversity
stringent guidelines	The National Biosafety Guidelines are clear, stringent and impede abuse of genetic engineering in the Philippines / Mexico
implementation	The implementation of the Biosafety Guidelines is not well ensured

Annex 3

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                    The CANDISC Procedure

          Pairwise Squared Distances Between Groups

          2         _   _          -1   _   _
         D (i|j) = (X - X )' COV   (X - X )
                    i   j               i   j


                   Squared Distance to CLUSTER

   From CLUSTER       1.0000         2.0000         3.0000

        1.0000            0         45.19930       19.17559
        2.0000        45.19930          0          8.17911
        3.0000        19.17559       8.17911          0


   F Statistics, NDF=7, DDF=41 for Squared Distance to CLUSTER

   From CLUSTER       1.0000         2.0000         3.0000

        1.0000            0         35.74623       22.05843
        2.0000        35.74623          0          7.68829
        3.0000        22.05843       7.68829          0
```

Observations:

1. The squared distance between clusters shows that cluster 1 is far from clusters 2 (45.19930) and 3 (19.17559). The distance of cluster 1 to cluster 2 is further compared to cluster 3.
2. Clusters 2 and 3 are closer (7.68829) to one another compared to Cluster 1.

This distances can also be observed in the Biplot. Please not that in the Biplot Cluster 2 and Cluster 3 were reversed for convenience purpose (to compare it with the Biplot and clusters obtained in the Philippines).

```
        Prob > Mahalanobis Distance for Squared Distance to CLUSTER

   From CLUSTER       1.0000         2.0000         3.0000

        1.0000        1.0000         <.0001         <.0001
        2.0000        <.0001         1.0000         <.0001
        3.0000        <.0001         <.0001         1.0000
```

Observations:

1. The Prob > Mahalanobis Distance gives a significant difference of squared distances (formula of squared distance given above) between 2 clusters. The pairwise comparison (Cluster 1 vs 2, Cluster 1 vs 3, Cluster 2 vs 3) shows significant probabilities (<0.0001), which indicates that the squared distances between clusters are different from each other (which makes a good separation of the groups)
2. Although clusters 2 and 3 are closer, it does not show that the squared distances are statistically the same. The probability above showed the statistical difference between clusters 2 and 3.