

# **THE SOCIAL AND CULTURAL DIMENSIONS OF AGRICULTURAL BIOTECHNOLOGY IN SOUTHEAST ASIA:**

## ***Public Understanding, Perceptions, and Attitudes towards Biotechnology in the Philippines***

### **I. INTRODUCTION**

This country monograph on the socio-cultural dimensions of agricultural biotechnology in the Philippines is a collaborative study by communication researchers from the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and the University of Illinois at Urbana-Champaign. It addresses the need for published research focusing on key stakeholders in agricultural biotechnology in developing countries. Specifically, the study seeks answers to the following questions: a) What do stakeholders generally know or understand about agricultural biotechnology? b) What are their views and opinions about the impact and role of biotechnology in their lives? c) Where do they obtain information and what kind of information do they get? and d) Who do they trust or have confidence in to tell the truth about biotechnology?

Utilizing close-ended, structured survey questionnaires largely patterned after the 1996 Eurobarometer public perception surveys, the study aims to establish a comprehensive, empirical, and in-depth documentation and analysis of public representations of biotechnology in developing countries, particularly those from Southeast Asia namely, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. Survey results are presented in country monographs that offer detailed information on how seven vital stakeholders such as consumers, businessmen, policy makers, farmer leaders, extension workers, journalists, and scientists relate to biotechnology issues and concerns. In the case of the Philippines, however, a survey among religious leaders has also been conducted due to the latter's visible involvements in biotechnology debates in the country.

By examining each of these stakeholders, the study hopes to identify the underlying social and cultural constructs that tend to shape public concern and perception of biotechnology, and to generate baseline data that can be used for tracking and comparing national and cross-national opinion trends. This study is particularly useful in comparing individual country data with overall regional data on public perceptions of biotechnology as well as similar studies such as those from the Asian Food Information Centre (AFIC), Eurobarometer, Japan, and the United States (IFIC).

The country monograph presents a profile of each stakeholder and a cross-sectoral analysis of the stakeholders. The observable differences in perceptions and attitudes toward biotechnology among country stakeholders offer policy makers, communication strategists, outreach educators, journalists, and planners a unique vantage point from which to understand and place in context the roots of public discourse and understanding about agricultural biotechnology in the Philippines. Comparative analyses across the five countries of the key seven stakeholders are contained in a separate summative and integrative monograph.

The stakeholders, who have been identified as belonging to the so-called attentive publics of agricultural biotechnology, are defined as follows:

a) Policy makers: Individuals whose decisions and opinions have significant influence or impact on national policies, laws, and regulations relating to agricultural biotechnology as well as on the overall directions of the country's agricultural development programs, including production, research, and trade. Policy makers may include senators, parliamentarians, legislators, elected representatives at the national level; members of legislative-level agricultural committees; national or regional officials in agriculture departments or ministries such as the agriculture minister/secretary, regional directors, and heads of units.

Officers and members of non-government organizations, no matter how influential, are not considered policy makers.

b) Journalists. This group includes media writers and broadcasters on television, radio, and print whose primary beat is science and technology. This may also include prominent columnists/opinion writers/commentators in major newspapers, radio, and television programs who have covered biotechnology and other science-technology issues.

c) Scientists. This refers to individual scientists who are not part of a country's crop biotechnology research consortium, but are often consulted by the mass media, NGOs, or other private groups for their individual scientific opinions or assessments relating to crop biotechnology. They are not strictly speaking generators of research information on biotechnology.

d) Farmer leaders and community leaders. This refers to heads of farmers' associations, cooperative groups, town mayors, councilors, members of a community council whose opinions and ideas tend to influence the overall dynamics of community debates or discourse on crop

biotechnology such as those relating to the field testing of biotech crops, risks, benefits, and safety issues.

e) Extension workers. This refers to the field-level staff of agriculture ministries, university action-research programs, or semi-academic research institutes who conduct outreach and information campaign programs on agriculture.

f) Consumers. This group is generally defined as urban supermarket goers and buyers who tend to be middle-class and have had at least some college education.

g) Businessmen and traders. Individuals who are directly involved in the food and agricultural industry.

h) Religious leaders<sup>1</sup>. This group refers to members of the Catholic clergy, pastors from Protestant churches, and Muslim clerics. This survey on religious leaders is specific only to the Philippines.

## II. METHOD

Survey instrument. Separate but parallel structured, close-ended questionnaires were designed and developed for each stakeholder survey. In general, the surveys covered a broad range of constructs relating to biotechnology, including demographic characteristics. Variables assigned to each construct were based on theoretical considerations as well as previous studies. The surveys focused on the following variables:

a) *Interest in and concern about agricultural biotechnology*. The wide space given to public discussions on biotechnology is assumed to have engendered varying degrees of interest and concern about biotechnology issues among different stakeholders. Interest can determine the respondents' behavioral intention to seek information about the issues or to be attentive to issues; hence, interested publics are also considered "attentive publics." Level of interest, however, does not necessarily translate into awareness or knowledge about biotech issues.

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<sup>1</sup> The addition of religious leaders to the Philippine study was based on the assumption that they would be an influential force in shaping public opinion on biotechnology, given their visibility in the Philippine media, their extensive community-based networks, and participation in civil society movements. The data on Philippine religious leaders are used for analysis in the Philippine study but are excluded from the regional cross-country comparisons and analyses.

On the other hand, “concern” implies some generic sense of uncertainty about the food safety, environmental and animal welfare consequences of food production systems, and the moral/ethical issues that customarily attend the introduction of innovations such as genetic modification. Level of concern, however, does not necessarily reflect the position a stakeholder takes about biotechnology.

In the surveys, respondents were asked to describe both their interest and concern in regard to the uses of biotechnology in food production on a seven-point scale ranging from 1 = “Not at all interested” through 7 = “Very interested,” with 4 = “Somewhat interested.” Concern was likewise measured using a seven-point scale from 1 = “Not at all concerned” through 7 = “Very concerned,” with 4 = “Somewhat concerned.”

b) *Perceived risks and benefits of biotechnology.* Perceived risks are seen as a crucial factor in understanding public support or opposition to technology. The fear of the unknown and potential hazards of biotechnology has always been part of the public discourse. In spite of the benefits associated with biotechnology, it is likely to be judged by the public not simply in terms of its scientific merits but with other fundamental questions pertaining to ethics, control, voluntariness, and other considerations. The public’s perception of risks is an important element in the development of public policies of risk management, particularly in the introduction of genetically engineered food and crops.

In the surveys, respondents were asked to rate the risks or hazards associated with the uses of biotechnology in food production on a seven-point scale ranging from 1 = “Not at all hazardous” through 7 = “Very hazardous,” with 4 = “Somewhat hazardous.” Likewise, they were asked to rate the benefits using a similar scale, 1 = “Not at all beneficial” through 7 = “Very beneficial,” with 4 = “Somewhat beneficial.”

c) *Perceptions of institutional concern and institutional accountability.* Issues of institutional concern and institutional accountability are crucial to understanding risk perception and attitudes to technology. Public acceptance of risk assessment findings generated either by scientists and experts or contrarian advocates depends on how these institutions or groups are perceived by the public as being trustworthy, i.e., they are seen as working “in the public interest.” How much the public thinks these institutions or societal groups are concerned about public health and safety issues in relation biotechnology is one measure of a group’s trustworthiness and this type of perception plays a crucial part in the decision making and adoption process. The other measure is

perceived responsibility for risk assessment and risk management. It is seen as a determinant of the public's view of institutions as having the competence and accountability for ensuring public health and safety.

Thus, in this study, perceived trustworthiness is conceptualized in two ways: a) the extent to which institutions or societal groups are perceived to be concerned or care about public health and safety issues with regard to agricultural biotechnology; and b) the extent to which institutions or groups are perceived to be responsible for assessing and managing the risks and benefits of agricultural biotechnology.

In order to measure perceived institutional concern, respondents were asked to rate each institution or societal group on a seven-point scale ranging from 1 = "Not at all concerned" through 7 = "Very concerned," with 4 = "Somewhat concerned." They were also given the option of answering 8 = "Not sure."

To measure perceived institutional responsibility, respondents were asked to rate each institution or societal group mentioned in the question on a seven-point scale ranging from 1 = "Not at all responsible" through 7 = "Totally responsible," with 4 = "Somewhat responsible." They were also given the option of answering 8 = "Not sure."

d) *Opinions, understanding, and knowledge about science and biotechnology.* Science plays an important role in developing and justifying public policies and legislation in the political and economic domain. At many different levels of everyday life, people now need to have a basic understanding of science and technology when making choices.

In these surveys, respondents were asked about their opinion about the role of science in agricultural development, their understanding of science, and their knowledge about the uses of biotechnology in food production. In each of these questions, a seven-point scale was used.

To ascertain their factual knowledge about biotechnology in food production, respondents were asked to answer "True," "False," or "Don't Know" on a 12-twelve statement "pop quiz" on biotechnology.

e) *Sources and characteristics of information on biotechnology.* The source and type of biotechnology information can have an effect on how people perceive risks.

In the surveys, respondents were asked to describe the frequency of contact they had, within the past two months, with interpersonal sources (e.g., family, friends, biotech experts, food regulators, NGOs, etc), general media sources (e.g., TV, radio, newspapers), and specialized

media sources (e.g., biotech websites, books, events, newsletters) on biotechnology. They were also asked to rate the usefulness of the information they received from each of these information sources on a seven-point scale where 1 = “Not at all useful” through 7 = “Totally useful,” with 4 = “Somewhat useful.”

Respondents were also asked to describe the extent of trust they have in each of the information sources. The seven-point scale ranged from 1 = “Not trust at all” through 7 = “Total trust,” with 4 = “Some trust.”

f) *Attitudes towards biotechnology.* Attitudes are a mental predisposition to act that is expressed by evaluating a particular entity with some degree of favor or disfavor. Attitudes are also a function of an individual beliefs and values. Hence, these beliefs and values on biotechnology are often manifested by the political leanings and societal worldviews of an individual that consequently have a bearing on his/her judgments about biotechnology. For example, individuals who support a more conservative type of governance are less averse to risk than respondents who support a more liberal government.

In order to ascertain attitudes, this study first asked respondents about the kinds of issues that would influence most their judgments on biotechnology such as political, religious, moral/ethical, cultural, and scientific. Second, they were asked to state their agreement or disagreement to a series of statements on biotechnology. Lastly, they were then asked to validate their judgments on specific applications of biotechnology in society in terms of usefulness, level of risk, moral acceptability, and promise.

B. Survey sample. In these surveys, the respective populations for the stakeholders involved were large and unknown. The questions asked of the respondents basically required “Yes” or “No” type of answers that generally classified the variables as being binomially distributed. In order to determine the population of positive responses for eight unknown populations, the sampling error was set around the 5% range and the level of confidence at 95%. For such level of confidence and sampling error, in practice, the required maximum sample is 385 for all stakeholders. Increasing this maximum sample would only yield the same sampling error and level of confidence.

In the Philippine surveys, this sample size was proportionately allocated among eight stakeholders namely consumers, businessmen, extension workers, farmer leaders, journalists,

policy makers, religious leaders, and scientists with no effects on the desired reliability. With a sample size of at least 340, there is a 95% level of confidence that the sample estimate of  $p$  will be within 5.3% of the true population proportion  $P$ . Thus, the percentages reported in this monograph can be seen as estimates of what the distribution of responses would be if the entire population of each stakeholder had been included in the survey.

C. Data collection. The Biotechnology Information Centers (BICs) and ISAAA's partner organizations in each of the five countries carried out the country surveys between April 15, 2002 and September 30, 2002. In the Philippines, the surveys were administered to a random sample of each stakeholder group namely, consumers, businessmen, extension workers, farmer leaders, religious leaders, journalists, policymakers, and scientists. The surveys were organized and conducted by the Biotechnology Information Center of the SEAMEO Center for Graduate Study and Research in Agriculture (SEARCA). The total sample for the Philippine surveys was six hundred six (606) respondents.

Included in this monograph are selected highlights of the data analyses such as basic descriptive statistics, correlational analyses, and results of the t-tests and analysis of variance. The Philippine monograph also includes valuable commentaries by renowned Filipino rural sociologist, Dr. Gelia T. Castillo of the International Rice Research Institute, and prominent science writer-advocate and Mathematics professor Dr. Queena Lee-Chua of the Ateneo de Manila University. They both bring in insightful reflections on the contexts and dynamics of Philippine discourses of agricultural biotechnology. The participation of Dr. Castillo and Dr. Lee-Chua in this study is deeply appreciated.

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### III. STAKEHOLDER PROFILES AND CROSS-STAKEHOLDER COMPARISONS

#### A. Interest and Concern

Interest in biotechnology. The overall mean interest score of Philippine stakeholders is 5.22, which indicates an above moderate interest in biotechnology and suggests the level of attention that stakeholders generally give to biotechnology in the Philippines. Level of interest, however, does not necessarily translate into having a high knowledge or taking a firm position about biotechnology issues.

Policy makers ( $\bar{x}=5.68 \pm .165$ ) and journalists ( $\bar{x}=5.43 \pm .244$ ) tend to show fairly high interest in agricultural biotechnology issues (Table 1). They are followed closely by businessmen ( $\bar{x}=5.42 \pm .184$ ), farmer leaders ( $\bar{x}=5.33 \pm .200$ ), and extension workers ( $\bar{x}=5.32 \pm .149$ ). These mean interest scores are almost fairly within the same range, however. There is no significant difference between the mean interest scores of these five stakeholders ( $p>.05$ ).

TABLE 1: INTEREST IN BIOTECHNOLOGY  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)<sup>2</sup>

Stakeholder (n=606)	Mean score ( $\pm$ s.e., max 7)*	Not at all interested	Moderately interested	Very interested**
Consumers (169)	4.85 $\pm$ .117 <sup>bc</sup>	11.83 $\pm$ 2.78	29.60 $\pm$ 3.51	58.57 $\pm$ 3.78 <sup>b,e,f,s</sup>
Businessmen (54)	5.42 $\pm$ .184 <sup>ab</sup>	5.60 $\pm$ 2.32	27.80 $\pm$ 4.85	66.60 $\pm$ 6.53 <sup>c,e,f,j,s</sup>
Extension Workers (92)	5.32 $\pm$ .149 <sup>ab</sup>	5.50 $\pm$ 2.37	29.30 $\pm$ 4.74	65.20 $\pm$ 4.96 <sup>c,e,j,s</sup>
Farmer Leaders (57)	5.33 $\pm$ .200 <sup>ab</sup>	7.00 $\pm$ 3.37	24.60 $\pm$ 5.70	66.70 $\pm$ 6.24 <sup>c,b,e,j,s</sup>
Religious Leaders (56)	4.23 $\pm$ .252	19.60 $\pm$ 5.30	39.30 $\pm$ 6.52	37.50 $\pm$ 6.46
Journalists (44)	5.43 $\pm$ .244 <sup>ab</sup>	4.60 $\pm$ 3.15	20.50 $\pm$ 6.08	73.00 $\pm$ 6.69 <sup>b,e,f,s</sup>
Policy Makers (97)	5.68 $\pm$ .165 <sup>a</sup>	5.20 $\pm$ 2.25	15.50 $\pm$ 3.67	77.30 $\pm$ 4.25
Scientists (37)	4.70 $\pm$ .385 <sup>c</sup>	- 0 -	18.90 $\pm$ 6.43	64.80 $\pm$ 7.85 <sup>c,b,e,f,j</sup>

\* Results of Comparison of Means by Analysis of Variance using the Duncan Test. Minimum score = 1 and Maximum score = 7. Different letter superscripts denote significant differences among stakeholders ( $p<.05$ ). Mean scores of Religious Leaders are not included in the analyses in order to provide for uniformity in cross-country comparisons.

\*\* Reports significant differences between “high” percentages across stakeholders. Significant difference with a “high” percentage of a stakeholder group is indicated by a letter corresponding to the first letter of that stakeholder group. All differences reported are significant at the 0.05 level. Example: 58.57% of consumers having high interest are significantly different from those of businessmen, extension workers, farmer leaders, and scientists. It is not significantly different from those of religious leaders, journalists, and policymakers.

<sup>2</sup> Percentages in the tables may not add up to 100% as “Don’t Know” or “Not sure” answers are not included.

Journalistic interest in biotechnology seems to mirror the prevailing coverage in the Philippine mass media about biotechnology issues. Most of the Philippine journalists (81.80%,  $\pm 5.81$ ) believe that biotechnology is a very important news story ( $\bar{x}=5.81 \pm .230$ ). Only 13% ( $\pm 5.16$ ) think it has moderate newsworthiness while 2.30% ( $\pm 2.25$ ) do not think biotechnology merits any coverage. There is a significant relationship between the journalists' degree of interest in biotechnology and their belief in biotechnology's newsworthiness ( $r=0.57$ ;  $p\leq 0.001$ ).

The seeming attraction of biotechnology to policy makers, businessmen, farmer leaders and extension workers can be explained partly by the need of these stakeholders to seek information and answers to questions they may face when dealing with their respective constituencies about biotechnology issues.

Although the mean interest score of Philippine religious leaders is slightly above moderate ( $\bar{x}= 4.23 \pm .252$ ), this score is significantly different from the rest of the Philippine stakeholders. It shows that, by comparison, religious leaders have the least interest in the issue.

However, it most intriguing to note that Philippine scientists have shown relatively less interest in biotechnology than other Philippine stakeholders. The mean interest score of Philippine scientists ( $\bar{x}=4.70 \pm .385$ ) is only slightly higher than the mean interest score of religious leaders and is almost just on par with the mean interest score of consumers ( $\bar{x}=4.85 \pm .117$ ). Moreover, it should be noted that the scientists' relatively low mean interest score of 4.70 is significantly different from those of other stakeholders who have expressed high interest in biotechnology issues.

Normally, scientists tend to lead the pack in showing a higher degree of interest in scientific and technological controversies such as biotechnology. If there has to be genuine conversation on biotechnology, the scientific community must be at the forefront in demonstrating enthusiasm and visibility in dealing with these issues. The results of the Philippine survey seem to imply the need for communication strategies that can generate an added measure of eagerness among the Philippine scientific community to participate, seek information, and be attentive to biotechnology issues.

The number of stakeholders expressing high interest in biotechnology validates the trends revealed by the mean scores. With the exception of religious leaders, nearly 60% of respondents in each stakeholder group report that they are very interested in biotechnology. Among these stakeholders, policy makers rank first in showing very high interest in agricultural biotechnology

(77.30%,  $\pm 4.25$ ). They are followed by journalists (73.00%,  $\pm 6.69$ ), farmer leaders (66.70%,  $\pm 6.24$ ), and businessmen (66.60%,  $\pm 6.53$ ).

Nearly 60% of consumers (58.57%,  $\pm 3.78$ ) claim that they are also highly interested in biotechnology, while 11.83% ( $\pm 2.78$ ) have expressed low interest. Less than 50% of religious leaders surveyed (37.50%,  $\pm 6.46$ ) have stated that they are very interested in biotechnology and a considerable 20% ( $\pm 5.30$ ) have indicated that they are not at all interested in the issue.

Philippine scientists rank third to the last in terms of the number of respondents saying that they are very interested in the uses of biotechnology in food production. Nearly 64% ( $\pm 7.85$ ) of Philippine scientists surveyed have indicated that they have high interest in biotechnology issues. Although this is still a decent number, it is significantly lower than the number of extension workers and farmer leaders who are highly interested in biotech issues ( $p \leq 0.05$ ). Ironically, the latter groups traditionally rely on scientists for information on new technologies. It should be noted that about 16% of the Philippine scientists surveyed have no answer to this particular question<sup>3</sup>.

Personal concern about biotechnology. The overall mean concern score for all Philippine stakeholders is 4.92, which indicates a slightly above moderate level of concern on biotechnology. In general, contrary to expectations that there is a much-heightened concern on biotechnology in the Philippines, the mean concern score appears to simply reflect the normal uncertainties, and questions that accompany new and unfamiliar technologies.

The stakeholders who have expressed high interest in biotechnology also tend to say that they are personally very concerned about the uses of biotechnology in food production (Table 2). Based on mean scores, a high degree of concern about biotechnology can be noted among extension workers ( $\bar{x} = 5.59 \pm .141$ ), policy makers ( $\bar{x} = 5.50 \pm .176$ ), farmer leaders ( $\bar{x} = 5.31 \pm .195$ ), and businessmen ( $\bar{x} = 5.29 \pm .212$ ) implying the level of direct involvement they have with

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<sup>3</sup> It must be clarified that the “scientists” referred to as a stakeholder group consists of “scientists-teachers” from state universities and colleges. They are individual scientists who are not part of a country’s crop biotechnology research consortium, but are often consulted by the mass media, NGOs, or other private groups for their individual scientific opinions or assessments relating to crop biotechnology. They do not generate research information on biotechnology. They are distinguished from scientists who are also based in universities but are directly involved in laboratory-based biotechnology studies. This latter group is referred to in this study as “University scientists.”

biotechnology issues. On the other hand, consumers show an above moderate mean concern score of 4.73 ( $\pm .103$ ).

In terms of the percentage of stakeholders expressing high concern (Table 2), 75.30% ( $\pm 4.37$ ) of policy makers surveyed say that they are highly concerned about biotechnology issues, followed by businessmen (70.40%,  $\pm 6.60$ ), extension workers (69.50%,  $\pm 4.80$ ), and farmer leaders (66.70%,  $\pm 6.24$ ). The differences between the percentages of these four stakeholders are significant at  $p \leq 0.05$ .

On the other hand, the journalists' personal concern mean score of 3.29 ( $\pm .271$ ) implies that biotechnology issues do not bother them personally as much as the others. This is also validated by a relatively large number of journalists (43.20%,  $\pm 7.46$ ) who say that they are not at all concerned about biotechnology. Only a quarter ( $\pm 6.52$ ) of the journalists say that they are very concerned. There is no significant correlation between the journalists' concern in biotechnology and their level of interest. Likewise, there is no significant association between their concern for biotechnology issues and their belief in the importance of biotechnology as a news story ( $p > 0.05$ ).

TABLE 2: PERSONAL CONCERN ABOUT BIOTECHNOLOGY  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean score ( $\pm$ s.e., max 7)	Not at all concerned	Moderately concerned	Very concerned
Consumers (169)	4.73 $\pm$ .103 <sup>bc</sup>	11.83 $\pm$ 2.48	36.10 $\pm$ 3.69	52.07 $\pm$ 3.84
Businessmen (54)	5.29 $\pm$ .212 <sup>ab</sup>	11.10 $\pm$ 3.23	18.50 $\pm$ 4.08	70.40 $\pm$ 6.60 <sup>c,e,f,p,s</sup>
Extension Workers (92)	5.59 $\pm$ .141 <sup>a</sup>	4.40 $\pm$ 2.13	26.00 $\pm$ 4.57	69.60 $\pm$ 4.80 <sup>c,b,f,p,s</sup>
Farmer Leaders (57)	5.31 $\pm$ .195 <sup>ab</sup>	3.50 $\pm$ 2.43	28.10 $\pm$ 5.95	66.70 $\pm$ 6.24 <sup>c,b,e,p,s</sup>
Religious Leaders (56)	4.57 $\pm$ .234	14.20 $\pm$ 4.66	44.60 $\pm$ 6.64	37.50 $\pm$ 6.46
Journalists (44)	3.29 $\pm$ .271 <sup>a</sup>	43.20 $\pm$ 7.46	25.00 $\pm$ 6.52	25.00 $\pm$ 6.52
Policy Makers (97)	5.50 $\pm$ .176 <sup>a</sup>	6.20 $\pm$ 2.44	15.50 $\pm$ 3.67	75.30 $\pm$ 4.37 <sup>b,e,f,p,s</sup>
Scientists (37)	4.64 $\pm$ .408 <sup>c</sup>	- 0 -	13.50 $\pm$ 5.61	67.56 $\pm$ 7.70 <sup>b,e,f,p</sup>

The mean score of religious leaders ( $\bar{x}$ =4.57 $\pm$  .234) does not appear to differ much from the level of interest they have in biotechnology. Even in terms of the number of religious leaders who say that they are either highly or moderately concerned about biotechnology issues reflects practically the same percentage of respondents expressing high or moderate interest in biotechnology. Indeed, as shown in Table 4, there is a strong correlation between their level of interest and concern ( $r=0.71$ ;  $p \leq 0.001$ ).

Among Philippine scientists, the survey results are rather intriguing. They are either moderately or highly concerned about biotechnology. Majority of the scientists surveyed (67.56%,  $\pm 7.70$ ) maintain that they are very concerned about the uses of biotechnology in food production. There is also a strong correlation between the scientists' interest and concern about biotechnology ( $r=0.67$ ;  $p\leq 0.001$ ).

Table 4 shows other strong and significant correlations at  $p\leq 0.001$  between the interest and concern among other Philippine stakeholders, except journalists. These associations suggest that increased interest in biotechnology also drives up levels of concern about biotechnology issues.

### ***B. Perceived risks and benefits of biotechnology***

Perceived risks. The overall mean score of 3.84 for perceived risks among Philippine stakeholders indicates a below moderate view that Philippine stakeholders have of the risks being associated with biotechnology.

Stakeholders who have a direct involvement with biotechnology such as businessmen and policy makers do not seem to associate biotechnology with high risks (Table 3a). Majority of the policy makers (43.30%,  $\pm 5.03$ ) believe that risks of biotechnology are rather low ( $\bar{x}=3.51 \pm .160$ ) while 22.70% ( $\pm 4.25$ ) say that the risks are high. Most of the businessmen ( $\bar{x}=3.53 \pm .178$ ; 48.10%,  $\pm 5.96$ ) think that the risks are moderate and only 18.50% ( $\pm 4.08$ ) say the risks are high.

There is no significant association between the concern expressed by policy makers and businessmen and their perceptions of risks relating to biotechnology (Table 4). Indeed, the level of concern expressed by businessmen and policy makers, as discussed earlier, may be projected much more towards addressing the needs of their specific publics or constituencies.

Generally, most of the consumers, extension workers, and farmer leaders have a mixed bag of impressions about risks relating to biotechnology. Nearly one-third of each of these stakeholders believes that the risks are low and another one-third says that the risks are high.

Although scientists show the lowest mean score on perceived risks ( $\bar{x}=3.02 \pm .380$ ), they are also rather divided nearly three ways on the issue of risk. About 30% ( $\pm 7.51$ ) of the scientists

think that biotechnology poses low risks; 21.60% ( $\pm 6.76$ ) say that it has moderate risks, and 24.32% ( $\pm 7.05$ ) believe that it carries high risks.

Among Philippine journalists, a considerable number (73%,  $\pm 6.69$ ) believes that the risks of biotechnology are rather high. Only 4.50% ( $\pm 3.12$ ) of the journalists think that the risks are low. They rank highest in mean scores of perceived risks ( $\bar{x}=5.06 \pm .296$ ). However, as noted in Table 4, journalists' perceptions of risks are not significantly related to their interest or concern about biotechnology issues ( $p>0.05$ ). There is no significant relationship between their perceptions of risks and their judgments about the importance of biotechnology as a news story ( $p>0.05$ ). On the other hand, this predisposition to have a view of biotechnology as posing high risks may be partly due to the need to balance risks and benefits issues on biotechnology in news reporting and other types of media coverage.

The views of Philippine religious leaders about the risks of biotechnology are surprisingly moderate ( $\bar{x}= 4.01 \pm .261$ ). They are almost evenly split up in their opinions. Around one-third (33.90%,  $\pm 6.32$ ) thinks that the risks are very high while another 33.90% say that risks are very low. Nearly 29% say that the risks are moderate. In Table 4, it can be noted that there is a significant relationship between the degree of concern religious leaders have about biotechnology and their perceptions of risks ( $r=0.36$ ;  $p\leq 0.01$ ). Religious leaders' concern about biotechnology issues goes hand in hand with their risk perceptions. When their concern goes up, so do their perceptions of risks and vice-versa.

*TABLE 3A: PERCEIVED RISKS OF BIOTECHNOLOGY  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)*

<i>Stakeholder (n=606)</i>	<i>Mean score (<math>\pm</math> s.e., max 7)</i>	<i>Low risks</i>	<i>Moderate risks</i>	<i>High risks</i>
Consumers (169)	4.01 $\pm$ .097 <sup>a</sup>	25.44 $\pm$ 3.35	47.92 $\pm$ 3.84	26.64 $\pm$ 3.40 <sup>b,e,f,r,p,s</sup>
Businessmen (54)	3.53 $\pm$ .178 <sup>abc</sup>	33.40 $\pm$ 5.22	48.10 $\pm$ 5.96	18.50 $\pm$ 4.08 <sup>c,e,p,s</sup>
Extension Workers (92)	3.68 $\pm$ .156 <sup>ab</sup>	32.70 $\pm$ 4.89	41.30 $\pm$ 5.13	25.00 $\pm$ 4.51 <sup>c,b,f,r,p,s</sup>
Farmer Leaders (57)	3.94 $\pm$ .182 <sup>a</sup>	26.40 $\pm$ 5.83	40.40 $\pm$ 6.49	31.60 $\pm$ 6.15 <sup>c,e,r,p,s</sup>
Religious Leaders (56)	4.01 $\pm$ .261	33.90 $\pm$ 6.32	28.60 $\pm$ 6.03	33.90 $\pm$ 6.32 <sup>c,e,f</sup>
Journalists (44)	5.06 $\pm$ .296 <sup>bc</sup>	4.50 $\pm$ 3.12	15.90 $\pm$ 5.51	73.00 $\pm$ 6.69
Policy Makers (97)	3.51 $\pm$ .160 <sup>abc</sup>	43.3 $\pm$ 5.03	30.90 $\pm$ 4.69	22.70 $\pm$ 4.25 <sup>c,b,e,f,s</sup>
Scientists (37)	3.02 $\pm$ .380 <sup>c</sup>	29.72 $\pm$ 7.51	21.60 $\pm$ 6.76	24.32 $\pm$ 7.05 <sup>c,b,e,f,p</sup>

Perceived benefits. Overall, Philippine stakeholders think that biotechnology brings above moderate benefits ( $\bar{x}$ =5.05). Remarkably, even as journalists think that biotechnology poses many hazards, they also believe that it can bring high benefits ( $\bar{x}$ = 5.88  $\pm$ .223). Indeed, as can be seen in Table 4, there is no relationship between their perceived risks and their perceived benefits ( $r$ = 0.22;  $p$ >.05).

A resounding majority of Philippine journalists (84.09%,  $\pm$  5.51) also believes that biotechnology brings high benefits (See Table 3b). There is a significant relationship between the journalists' perception of benefits and a) their degree of interest in biotechnology ( $r$ =0.62;  $p$ ≤ 0.001) and b) their assessment of biotechnology as a worthy news story ( $r$ =0.56;  $p$ ≤ 0.001). To some extent, it can be safely surmised that the journalists' gauge of newsworthiness tends to be propelled in part by their interest in biotechnology and its possible benefits rather than on public concerns and perceived risks. Considering both risks and benefits, as mentioned earlier, may simply be reflective of the conventional balancing act that journalists do when covering or reporting about new technologies. Implicit canons of media reporting compel them to look into both the risks and benefits.

Looking at other stakeholders, majority of the policy makers (71.10%,  $\pm$  4.60) also believe that the benefits of biotechnology are high. Extension workers (69.50%,  $\pm$  4.80) and businessmen (61.10%,  $\pm$  6.39) share these sentiments.

Compared to other stakeholders, religious leaders tend to have the least appreciation for the benefits of biotechnology ( $\bar{x}$ =4.05  $\pm$  .234). Nonetheless, they seem to be quite undecided about the question of benefits. Less than one-third (30.30%,  $\pm$  6.14) of religious leaders believe that biotechnology results in potential benefits and 25% think that the benefits are very low.

Philippine scientists are second to the last in terms of their belief in the benefits of biotechnology. Only 59.45% ( $\pm$  8.07) think it has high benefits. Their mean score in perceived benefits of 4.48 ( $\pm$  .407) is only slightly above the mean score of religious leaders 4.05 ( $\pm$  .234) and much lower than farmer leaders and consumers.

Overall, very strong and significant relationships at  $p$ ≤ 0.001 can be seen between perceived benefits and degrees of interest across all stakeholders (Table 4). Likewise, there is a significant relationship between level of concern and perceived benefits of biotechnology as can be observed among farmer leaders, religious leaders, policy makers, and scientists,

Among consumers, businessmen, extension workers, and policy makers, there is a negative and significant correlation ( $p \leq 0.001$ ) between their perceived risks and perceived benefits indicating that as perceptions of benefits increase, there is a corresponding decrease in perceived risks and vice-versa.

*TABLE 3B: PERCEIVED BENEFITS OF BIOTECHNOLOGY  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)*

<i>Stakeholder (n=606)</i>	<i>Mean score (<math>\pm</math> s.e., max 7)</i>	<i>Low benefits</i>	<i>Moderate benefits</i>	<i>High benefits</i>
Consumers (169)	4.81 $\pm$ .103 <sup>a,b</sup>	9.46 $\pm$ 2.25	36.10 $\pm$ 3.69	54.44 $\pm$ 3.83 <sup>b,f,s</sup>
Businessmen (54)	5.09 $\pm$ .191 <sup>a,b</sup>	5.60 $\pm$ 2.31	33.30 $\pm$ 5.22	61.10 $\pm$ 6.39 <sup>c,e,f,p,s</sup>
Extension Workers (92)	5.23 $\pm$ .135 <sup>a</sup>	5.50 $\pm$ 2.37	25.00 $\pm$ 4.51	69.50 $\pm$ 4.80 <sup>b,f,p,s</sup>
Farmer Leaders (57)	4.52 $\pm$ .234 <sup>b</sup>	21.00 $\pm$ 5.39	22.80 $\pm$ 5.55	52.60 $\pm$ 6.61 <sup>c,b,s</sup>
Religious Leaders (56)	4.05 $\pm$ .234	25.00 $\pm$ 5.78	41.10 $\pm$ 6.57	30.30 $\pm$ 6.14
Journalists (44)	5.88 $\pm$ .223 <sup>a,b</sup>	2.30 $\pm$ 2.25	11.40 $\pm$ 4.79	84.09 $\pm$ 5.51
Policy Makers (97)	5.39 $\pm$ .143 <sup>a</sup>	5.10 $\pm$ 2.23	22.70 $\pm$ 1.51	71.10 $\pm$ 4.60 <sup>b,e</sup>
Scientists (37)	4.48 $\pm$ .407 <sup>b</sup>	5.40 $\pm$ 3.71	16.20 $\pm$ 6.05	59.45 $\pm$ 8.07 <sup>c,b,f</sup>

*TABLE 4: CORRELATION SUMMARY FOR INTEREST, CONCERN,  
PERCEIVED RISKS, & PERCEIVED BENEFITS  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)*

<i>Stakeholder (n=606)</i>	<i>Interest &amp; Concern</i>	<i>Interest &amp; Perceived risks</i>	<i>Interest &amp; Perceived benefits</i>	<i>Concern &amp; Perceived risks</i>	<i>Concern &amp; Perceived benefits</i>	<i>Perceived benefits &amp; Perceived risks</i>
Consumers (169)	<b>0.60787<sup>a</sup></b>	-0.02103	<b>0.49086<sup>a</sup></b>	0.15027	0.28819	-0.27099 <sup>a</sup>
Businessmen (54)	<b>0.41357<sup>b</sup></b>	<b>-0.54913<sup>a</sup></b>	<b>0.50241<sup>a</sup></b>	0.02853	0.01592	<b>-0.49076<sup>a</sup></b>
Extension Workers (92)	<b>0.47385<sup>a</sup></b>	-0.29835 <sup>c</sup>	<b>0.48489<sup>a</sup></b>	0.04549	0.24425 <sup>c</sup>	<b>-0.36962<sup>a</sup></b>
Farmer Leaders (57)	<b>0.57165<sup>a</sup></b>	-0.28860 <sup>c</sup>	<b>0.51335<sup>a</sup></b>	-0.04986	0.58906 <sup>a</sup>	-0.23916
Religious Leaders (56)	<b>0.71045<sup>a</sup></b>	0.12890	<b>0.65736<sup>a</sup></b>	<b>0.36154<sup>b</sup></b>	<b>0.57276<sup>a</sup></b>	0.04721
Journalists (44)	-0.22698	0.27071	<b>0.62169<sup>a</sup></b>	0.15755	0.01349	0.22755
Policy Makers (97)	<b>0.64044<sup>a</sup></b>	-0.28691 <sup>c</sup>	<b>0.49496<sup>a</sup></b>	-0.07937	<b>0.32003<sup>b</sup></b>	<b>-0.41030<sup>a</sup></b>
Scientists (37)	<b>0.67280<sup>a</sup></b>	0.22335	<b>0.65857<sup>a</sup></b>	<b>0.41273<sup>b</sup></b>	<b>0.61673<sup>a</sup></b>	0.17160

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

### C. *Perceptions of institutions as being concerned about health and safety*

Stakeholders' perceptions of institutional concern about health and safety. Out of eight societal groups or institutions<sup>4</sup>, all but one Philippine stakeholder have commonly cited *research institutes*<sup>5</sup> as being most concerned about public health and safety issues relating to agricultural biotechnology (Table 5). A majority of the consumers (89.30%,  $\pm$  2.31), extension workers (83.69%,  $\pm$  3.85), businessmen (75.90%,  $\pm$  6.69), policy makers (73.10%,  $\pm$  4.50), farmer leaders (72%,  $\pm$  5.94) and even religious leaders (62.50%,  $\pm$  6.46) believe that research institutes are concerned about health and safety issues on agricultural biotechnology.

Interestingly, only 59.40% ( $\pm$  8.21) of Philippine scientists have expressed confidence that research institutes care about health and safety concerns relating to biotechnology.

Five out of eight stakeholders believe that *consumer advocacy groups and other NGOs and university scientists* are very highly concerned about public health and safety issues. Businessmen (79.70%,  $\pm$  6.73), policy makers (74.30%,  $\pm$  4.43), scientists (70.27%,  $\pm$  7.51), extension workers (69.50%,  $\pm$  4.80), and religious leaders (53.50%,  $\pm$  6.66) believe that consumer advocacy groups and NGOs can be highly trusted when it comes to expressing concerns about these issues.

This finding is quite noteworthy because consumer advocacy groups and NGOs tend to be sources of arguments relating to the social, cultural, and economic impacts of biotechnology. Thus, initiatives to hold public communication dialogue about biotechnology will have to consider the affective attraction to stakeholders of societal groups who are perceived of as standing up for citizens' needs and consumer rights.

*University scientists* rank high in the list of five stakeholders, particularly among journalists (88.60%,  $\pm$  4.79), consumers (75.20%,  $\pm$  3.32), policy makers (74.20%,  $\pm$  4.44), businessmen (74.00%,  $\pm$  6.66), and scientists (64.86%,  $\pm$  7.85). The perceived neutrality customarily associated with academic institutions partly explains these high approvals.

What is most interesting about the scientists stakeholder group, however, is that they tend to believe that consumer advocacy groups & NGOs are more concerned about public health and safety issues than their colleagues (i.e., university scientists) who are directly working on

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<sup>4</sup> These groups are: a) University scientists, b) Private sector scientists, c) Agri-biotech companies, d) Consumer groups & NGOs, e) National farm leaders, f) Mass media/journalists, g) Religious groups, and h) Research institutes.

<sup>5</sup> The top three choices of each stakeholder (see Table 5) are in bold.

biotechnology. Scientists have given comparatively less votes to their colleagues as having concern about health and safety issues. This is also evident in the mean scores for perceived concern. Scientists give consumer advocacy groups and NGOs ( $\bar{x}$ =4.94  $\pm$  .450) a slim edge of approval over university scientists ( $\bar{x}$ =4.54  $\pm$  .441).

*TABLE 5: INSTITUTIONS PERCEIVED AS BEING CONCERNED ABOUT HEALTH AND SAFETY ISSUES RELATING TO BIOTECHNOLOGY (PERCENTAGE REPORT ON HIGHLY CONCERNED)*

Stakeholder (n=606)	Institutions							
	University scientists	Private sector scientists	Agri-biotech companies	Consumer groups & NGOs	National farm leaders	Mass media	Religious groups	Research institutes
Consumers	<b>75.20</b> $\pm$ 3.32	59.76 $\pm$ 3.77	<b>72.18</b> $\pm$ 3.44	53.84 $\pm$ 3.83	49.00 $\pm$ 3.85	51.47 $\pm$ 3.84	39.64 $\pm$ 3.76	<b>89.30</b> $\pm$ 2.31
Businessmen	<b>74.00</b> $\pm$ 6.66	64.80 $\pm$ 6.49	61.10 $\pm$ 6.39	<b>79.70</b> $\pm$ 6.73	53.70 $\pm$ 6.04	53.80 $\pm$ 6.17	63.00 $\pm$ 6.44	<b>75.90</b> $\pm$ 5.82
Extension workers	65.20 $\pm$ 4.96	54.34 $\pm$ 5.19	57.60 $\pm$ 5.15	<b>69.50</b> $\pm$ 4.80	50.00 $\pm$ 5.21	<b>66.30</b> $\pm$ 4.92	60.86 $\pm$ 5.08	<b>83.69</b> $\pm$ 3.85
Farmer Leaders	50.60 $\pm$ 6.62	<b>61.40</b> $\pm$ 6.44	<b>61.40</b> $\pm$ 6.44	61.30 $\pm$ 6.44	57.80 $\pm$ 6.54	57.80 $\pm$ 6.54	43.90 $\pm$ 6.57	<b>72.00</b> $\pm$ 5.94
Religious Leaders	50.00 $\pm$ 6.68	37.50 $\pm$ 6.46	48.20 $\pm$ 6.67	<b>53.50</b> $\pm$ 6.66	37.50 $\pm$ 6.46	44.60 $\pm$ 6.64	<b>67.80</b> $\pm$ 6.24	<b>62.50</b> $\pm$ 6.46
Journalists	<b>88.60</b> $\pm$ 4.79	68.20 $\pm$ 7.02	72.70 $\pm$ 6.71	72.70 $\pm$ 6.72	<b>75.00</b> $\pm$ 6.52	<i>Not asked</i>	61.36 $\pm$ 7.34	<b>88.63</b> $\pm$ 4.78
Policy Makers	<b>74.20</b> $\pm$ 4.44	66.00 $\pm$ 4.80	63.90 $\pm$ 4.87	<b>74.30</b> $\pm$ 4.43	52.60 $\pm$ 5.06	67.00 $\pm$ 4.77	56.70 $\pm$ 5.03	<b>78.30</b> $\pm$ 4.50
Scientists	<b>64.86</b> $\pm$ 7.85	<b>62.16</b> $\pm$ 7.97	43.24 $\pm$ 8.14	<b>70.27</b> $\pm$ 7.51	48.64 $\pm$ 8.21	43.24 $\pm$ 8.14	54.05 $\pm$ 8.19	59.40 $\pm$ 8.21

Table 5 above shows how the Philippine stakeholders have assessed the other institutions or groups in terms of their concern for health and safety issues relating to biotechnology. Comparatively, farm leaders, the mass media, and religious groups do not get as many favorable votes as the others. The mass media, which would have been normally considered as a vital influence, does not make it to the top list of most stakeholders, except among extension workers (66.30%,  $\pm$ 4.92). This may be partly due to the frequent interaction between extension and mass media in outreach activities.

Not surprisingly, religious leaders have favored their own groups (67.80%,  $\pm$ 6.24). However, it is interesting to note that Philippine consumers, farmer leaders, and journalists have looked at

religious groups as being least concerned about health and safety issues compared to other institutions.

#### ***D. Perceptions of institutional responsibility for risk assessment and risk management***

Stakeholders' perceptions of institutional responsibility to conduct risk assessment and risk management. When asked about which institutions<sup>6</sup> they believe should conduct risk assessment and risk management, Philippine stakeholders have turned towards science-based institutions (Table 6). They tend to be unanimous about the role of *regulatory bodies*, *research institutes*, and *agri-biotech companies* in risk assessment and risk management. All eight stakeholders have mentioned regulatory bodies and research institutes as being on top of their list of institutions they believe should be responsible for risk assessment and risk management.

In particular, at least 90% of policy makers have mentioned these groups as being totally responsible when it comes to risk assessment and risk management, and around 70% of religious leaders believe that these groups should be responsible for risk assessment and management. Consumers, businessmen, farmer leaders, journalists, policy makers, and scientists view religious groups as having least responsibility in matters pertaining to the risk assessment and risk management of agricultural biotechnology.

The role being attributed to science-based groups appears to negate the assumption that, with the growing clamor for public participation in regulatory and risk management processes, stakeholders will look towards increased involvement of public interest groups such as consumer advocacy groups, NGOs, and national farm leaders. This can be seen in a couple of ways. It can imply that respondents only trust regulatory bodies, research institutes, agri-biotech companies, and university scientists as having the capabilities and the competence to conduct risk assessment and management. On the other hand, it may also suggest that respondents regard these scientific institutions as being the only entities that can possibly resolve the biotechnology issues or problems they have generated themselves.

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<sup>6</sup> These institutions or societal groups are: a) University scientists, b) Private sector scientists, c) Agri-biotech companies, d) Consumer groups & NGOs, e) National farm leaders, f) Mass media/journalists, g) Religious groups, h) Research institutes, and i) Regulatory bodies.

**TABLE 6: INSTITUTIONS PERCEIVED AS RESPONSIBLE FOR RISK ASSESSMENT & RISK MANAGEMENT<sup>7</sup>**  
(PERCENTAGE REPORT ON TOTALLY RESPONSIBLE)

Stakeholder (n=606)	Institutions								
	University scientists	Private sector scientists	<b>Agri- biotech companies</b>	Consumer groups & NGOs	Nat'l farm leadrs	Mass media	Religious groups	<b>Research institutes</b>	<b>Regulatory bodies</b>
Consumers	78.69 ± 3.14 b,f,j,s	73.37 ± 3.38 b,e,j,s	<b>87.57</b> ± 2.53 b,e,f,j,p,s	55.62 ± 3.82 f, r, s	53.85 ± 3.84 e,f,r,s	60.35 ± 3.76 b,f,r,s	36.09 ± 3.69 s	<b>90.53</b> ± 2.25 b,e,f,j,p	<b>92.90</b> ± 1.98 b,e,f,p
Businessmen	79.60 ± 6.73 <sup>c,f,j,s</sup>	72.30 ± 6.63 c,e,j,s	<b>89.00</b> ± 6.79 c,e,f,j,p	72.20 ± 6.63 e,f,j,p,s	76.00 ± 6.69 j	68.50 ± 6.57 c,e,p	59.30 ± 6.34 e,f,r,j,p	<b>88.90</b> ± 6.79 c,e,f,j	<b>88.90</b> ± 6.79 c,e,f,j
Extension workers	<b>88.00</b> ± 3.38 f,p,s	80.43 ± 4.13 c,b,j,s,f	86.90 ± 3.51 c,b,f,j,p,s	67.39 ± 4.88 b,f,j,p,s	54.34 ± 5.19 c,f,r,j,p,s	71.73 ± 4.69 b,p	58.69 ± 5.13 b,f,r,j,p	<b>91.30</b> ± 2.93 c,b,f,p	<b>90.20</b> ± 3.09 c,b,f,p
Farmer leaders	86.00 ± 4.59 c,b,e,p,s	82.40 ± 5.04 e,j,s	<b>89.30</b> ± 4.06 c,b,e,j,p	64.90 ± 6.32 c,b,e,j,p,s	59.70 ± 6.49 c,b,e,j,p,s	55.60 ± 6.58 c,r,s	50.80 ± 6.62 b,e,r,j,s	<b>89.50</b> ± 4.06 c,b,f,j	<b>87.70</b> ± 4.35 c,b,f,j
Religious leaders	62.50 ± 6.46	50.00 ± 6.68	<b>69.60</b> ± 6.14	48.20 ± 6.67 c	48.20 ± 6.67 c,e,f,s	53.50 ± 6.66 c,f,s	53.50 ± 6.66 b,e,f,j,p,s	<b>76.70</b> ± 5.64 s	<b>82.10</b> ± 5.12 s
Journalists	77.27 ± 6.31 c,b,s	75.00 ± 6.52 c,b,e,f,s	<b>81.81</b> ± 5.81 c,b,e,f,s	75.00 ± 6.52 b,e,f,p	77.27 ± 6.31 b	<i>Not asked</i>	56.81 ± 7.46 b,e,f,r,p	<b>84.09</b> ± 5.51 c,b,f	<b>81.81</b> ± 5.81 c,b,f
Policy makers	<b>93.80</b> ± 2.44 e,f	91.70 ± 2.80	<b>93.80</b> ± 2.44 c,b,e,f	72.10 ± 4.55 b,e,f,r,p,s	64.90 ± 4.84 e,f,s	73.20 ± 4.49 b,e	61.90 ± 4.93 b,e,r,j	<b>96.80</b> ± 1.78 c,e	<b>96.90</b> ± 1.75 c,e
Scientists	<b>83.78</b> ± 6.07 c,b,e,f,j	78.37 ± 6.79 c,b,e,f,j	<b>81.08</b> ± 6.44 c,e,j	62.16 ± 7.97 b,e,f,r,p,s	56.75 ± 8.14 c,e,f,r,p	51.35 ± 8.21 c,fr	43.24 ± 8.07 c,fr	<b>81.08</b> ± 6.44 r	<b>83.78</b> ± 6.07 r

**E. Role of science in Philippine agricultural development**

Role of science in agricultural development. In general, Philippine stakeholders are rather undivided in the notion that science plays a pivotal role in the development of Philippine agriculture (Table 7a). The overall mean rating of Philippine stakeholders on their assessment of the role of science in agricultural development is 6.28. At least 90% of policy makers ( $\bar{x}$ =6.75 ± .068), extension workers ( $\bar{x}$ =6.58 ± .101), farmer leaders ( $\bar{x}$ =6.40 ± .117), businessmen ( $\bar{x}$ =6.37 ± .179), and journalists ( $\bar{x}$ =6.18 ± .278) have all expressed high appreciation for the role of science in Philippine agriculture.

<sup>7</sup> The top three choices of each stakeholder are in bold.

Even among Philippine religious leaders, a considerable (73.20%,  $\pm 5.91$ ) believes that science is important in agricultural development. However, Philippine scientists can only muster a comparatively low 83.78% ( $\pm 6.07$ ) who think very highly of science's role in agriculture. This number is just barely above the 81.06% ( $\pm .301$ ) of consumers who share the same sentiments. The difference between these two percentages is significant at  $p \leq 0.05$ . It is also worth noting that the rating of scientists ( $\bar{x} = 5.81 \pm .427$ ) is lower than the rating given by consumers ( $\bar{x} = 5.88 \pm .093$ ), although there is no significant difference between these two ratings. Around 16% of the Philippine scientists surveyed have either said "Not sure" or not responded at all to this particular question.

TABLE 7A: BELIEF IN THE IMPORTANCE OF SCIENCE IN PHILIPPINE AGRICULTURAL DEVELOPMENT  
(MEAN RATINGS AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean rating ( $\pm s.e.$ , max 7)	Not at all important	Somewhat important	Very important
Consumers (169)	5.88 $\pm$ .093 <sup>c</sup>	- 0 -	18.90 $\pm$ 3.01	81.10 $\pm$ 3.01 <sup>s</sup>
Businessmen (54)	6.37 $\pm$ .179 <sup>ab</sup>	- 0 -	9.30 $\pm$ 2.96	88.90 $\pm$ 6.79 <sup>j,s</sup>
Extension Workers (92)	6.58 $\pm$ .101 <sup>ab</sup>	- 0 -	2.17 $\pm$ 1.51	96.73 $\pm$ 1.85 <sup>f,j,p</sup>
Farmer Leaders (57)	6.40 $\pm$ .117 <sup>ab</sup>	- 0 -	3.50 $\pm$ 2.43	96.50 $\pm$ 2.43 <sup>e,j,p</sup>
Religious Leaders (56)	5.69 $\pm$ .233	5.30 $\pm$ 2.99	17.90 $\pm$ 5.12	73.20 $\pm$ 5.91
Journalists (44)	6.18 $\pm$ .278 <sup>bc</sup>	- 0 -	2.30 $\pm$ 2.25	93.18 $\pm$ 3.80 <sup>b,e,f,p</sup>
Policy Makers (97)	6.75 $\pm$ .068 <sup>a</sup>	- 0 -	4.10 $\pm$ 2.01	95.90 $\pm$ 2.01 <sup>e,f,j</sup>
Scientists (37)	5.81 $\pm$ .427 <sup>c</sup>	- 0 -	- 0 -	83.78 $\pm$ 6.07 <sup>c,b</sup>

TABLE 7B: CORRELATION BETWEEN BELIEF IN SCIENCE, INTEREST & PERCEIVED BENEFITS OF BIOTECHNOLOGY  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)

<i>Stakeholder (n=606)</i>	<i>Interest in biotechnology &amp; Role of science</i>	<i>Perceived benefits of biotechnology &amp; Role of science</i>
Consumers (169)	<b>0.31006<sup>a</sup></b>	<b>0.34079<sup>a</sup></b>
Businessmen (54)	<b>0.41654<sup>a</sup></b>	<b>0.41203<sup>b</sup></b>
Extension Workers (92)	<b>0.39889<sup>a</sup></b>	0.29409 <sup>b</sup>
Farmer Leaders (57)	0.22151	<b>0.43004<sup>a</sup></b>
Religious Leaders (56)	<b>0.45793<sup>a</sup></b>	<b>0.52092<sup>a</sup></b>
Journalists (44)	0.22173	0.20236
Policy Makers (97)	<b>0.30607<sup>c</sup></b>	0.24025 <sup>c</sup>
Scientists (37)	<b>0.63061<sup>a</sup></b>	<b>0.61871<sup>a</sup></b>

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

Moderate to strong correlations can be noted between the level of interest in biotechnology and the belief in the importance of science in agricultural development as well as between perceived benefits and the belief in the role of science in agriculture (Table 7b). These significant correlations are apparent in most stakeholders, except among journalists. The results connote that increased interest in biotechnology and an appreciation for its benefits usually go along with recognizing science as vital to agricultural development. Strong and significant correlations can also be noted among consumers, businessmen, farmer leaders, religious leaders, and scientists in terms of their perceived benefits of biotechnology and their belief in the role of science in agricultural development.

#### ***F. Understanding of science and biotechnology***

Self-rate understanding of science. In general, stakeholders estimate their understanding of science as just slightly above moderate ( $\bar{x}$ =4.63). Policy makers generally consider their understanding of science as quite high ( $\bar{x}$ =5.34 ± 1.30), with 73.20% (±4.49) saying that they do

have a very good understanding of science (Table 8). Only 3.10% ( $\pm 1.75$ ) of policy makers believe that they have a poor grasp of science.

Nearly 60% of farmer leaders (59.70%,  $\pm 6.49$ ) and journalists (56.81%,  $\pm 7.46$ ) have given themselves relatively high ratings in this regard and these numbers are reflected as well in their respective mean ratings of 4.63 ( $\pm .193$ ) and 4.65 ( $\pm .255$ ). Only 6.80% ( $\pm 3.79$ ) of journalists claim to have a rather poor understanding of science.

TABLE 8: SELF-RATE UNDERSTANDING OF SCIENCE  
(MEAN RATINGS AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean rating ( $\pm$ s.e., max 7)	Low	Moderate	High
Consumers (169)	4.59 $\pm$ .081 <sup>b</sup>	10.10 $\pm$ 2.31	41.40 $\pm$ 3.78	48.50 $\pm$ 3.84 <sup>b,e,j</sup>
Businessmen (54)	4.64 $\pm$ .194 <sup>b</sup>	9.30 $\pm$ 2.96	33.30 $\pm$ 5.22	53.70 $\pm$ 6.17 <sup>c,e,f,j</sup>
Extension Workers (92)	4.54 $\pm$ .127 <sup>b</sup>	13.04 $\pm$ 3.51	39.10 $\pm$ 5.08	46.73 $\pm$ 5.20 <sup>c,b,j</sup>
Farmer Leaders (57)	4.63 $\pm$ .193 <sup>b</sup>	17.60 $\pm$ 5.04	21.10 $\pm$ 5.39	59.70 $\pm$ 6.49 <sup>b,j</sup>
Religious Leaders (56)	4.08 $\pm$ .171 <sup>b</sup>	16.00 $\pm$ 4.89	50.00 $\pm$ 6.68	30.30 $\pm$ 6.14
Journalists (44)	4.65 $\pm$ .255 <sup>b</sup>	6.80 $\pm$ 3.79	29.50 $\pm$ 6.87	56.81 $\pm$ 7.46 <sup>c,b,e,f</sup>
Policy Makers (97)	5.34 $\pm$ .130 <sup>a</sup>	3.10 $\pm$ 1.75	23.70 $\pm$ 4.31	73.20 $\pm$ 4.49
Scientists (37)	Not asked			

Businessmen ( $\bar{x}$ =4.64  $\pm$  .194) are also quite confident about their knowledge of science. Around 53% ( $\pm 6.17$ ) profess to have a very good comprehension of science and only 9.30% ( $\pm 2.96$ ) think otherwise.

The number of consumers and extension workers who declare that they have a very good understanding hovers near the 50% mark if standard errors are considered. Nonetheless, these numbers are definitely lower than those of businessmen ( $p \leq 0.05$ ) and considerably less than those of policy makers and journalists ( $p \leq 0.05$ ). Clearly half of the religious leaders surveyed, on the other hand, say that they have a moderate understanding of science. Only 30.30% ( $\pm 6.14$ ) maintain that their understanding of science is more than adequate, and 16% ( $\pm 4.89$ ) think that it is poor.

Self-rate knowledge/understanding of biotechnology. When it comes to qualifying their knowledge of biotechnology, nearly two-thirds of Philippine stakeholders tend to consider themselves as just having a moderate understanding ( $\bar{x}$ = 4.21). Evidently, the numbers are unlike

their self-assessments of understanding science. Likewise, the mean ratings indicate a slightly above moderate self-rating on knowledge of biotechnology, with policy makers showing comparatively higher mean ratings ( $\bar{x}=4.67 \pm .124$ ). Religious leaders report the lowest self-rating about knowledge of biotechnology ( $\bar{x}=3.76 \pm .165$ ). Only 3.60% ( $\pm 2.48$ ) of the religious leaders claim to have a very good knowledge of biotechnology; 66.10% ( $\pm 6.32$ ) say that they have a moderate knowledge, and a considerable 30.30% ( $\pm 6.14$ ) believe that their knowledge is inadequate.

Among Philippine consumers, a clear majority (74.60%  $\pm 3.34$ ) say that their knowledge of biotechnology is only a tad moderate ( $\bar{x}=4.16 \pm .075$ ). About 20% ( $\pm 3.11$ ) believe that their knowledge is rather low, and only 4.69% ( $\pm 1.62$ ) are very confident about their knowledge of biotechnology.

TABLE 9: SELF-RATE KNOWLEDGE OF BIOTECHNOLOGY  
(MEAN RATINGS AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606))	Mean score ( $\pm$ s.e., max 12)	Low	Moderate	High
Consumers (169)	4.16 $\pm$ .075 <sup>b</sup>	20.71 $\pm$ 3.11	74.60 $\pm$ 3.34	4.69 $\pm$ 1.62 <sup>b,e,f</sup>
Businessmen (54)	4.20 $\pm$ .189 <sup>b</sup>	20.40 $\pm$ 5.48	62.90 $\pm$ 6.57	16.70 $\pm$ 5.07 <sup>c,e,f</sup>
Extension Workers (92)	4.40 $\pm$ .117 <sup>ab</sup>	10.90 $\pm$ 3.25	48.90 $\pm$ 5.21	39.10 $\pm$ 5.09 <sup>c,b,f</sup>
Farmer Leaders (57)	4.07 $\pm$ .175 <sup>b</sup>	21.10 $\pm$ 5.40	63.10 $\pm$ 6.39	15.80 $\pm$ 4.83 <sup>c,b,e</sup>
Religious Leaders (56)	3.76 $\pm$ .165	30.30 $\pm$ 6.14	66.10 $\pm$ 6.32	3.60 $\pm$ 2.48
Journalists (44)	4.43 $\pm$ .223 <sup>ab</sup>	9.10 $\pm$ 4.33	70.40 $\pm$ 6.88	20.50 $\pm$ 6.08 <sup>p,s</sup>
Policy Makers (97)	4.67 $\pm$ .124 <sup>a</sup>	13.40 $\pm$ 3.45	64.90 $\pm$ 4.84	21.70 $\pm$ 4.18 <sup>j,s</sup>
Scientists (37)	4.05 $\pm$ .400	18.90 $\pm$ 6.43	59.40 $\pm$ 7.05	21.70 $\pm$ 6.78 <sup>j,p</sup>

Indeed, fewer respondents have asserted that they have a very good grasp of biotechnology. Even among scientists, only 21.60% ( $\pm 6.76$ ) say that they know a lot about biotechnology. This number is significantly lower by a few numbers from policy makers (21.70%,  $\pm 4.18$ ) and just slightly above those of journalists (20.50%,  $\pm 6.08$ ). Likewise, there are more scientists (18.90%,  $\pm 6.43$ ) reporting that they do not know much about biotechnology compared to journalists (9.10%,  $\pm 4.33$ ) and policy makers (13.40%,  $\pm 3.45$ ). The mean score of scientists at 4.05 ( $\pm .400$ ) is second to the last. Religious leaders have posted the lowest mean rating at 3.76 ( $\pm .165$ ).

Strong and significant correlations have been noted between self-rate understanding of science and self-rate knowledge of biotechnology among: a) consumers ( $r=0.53$ ;  $p \leq 0.001$ ), b)

policy makers ( $r=0.54$ ;  $p\leq 0.001$ ), c) extension workers ( $r=0.56$ ;  $p\leq 0.001$ ), d) religious leaders ( $r=0.56$ ;  $p\leq 0.001$ ), e) farmer leaders ( $r= 0.60$ ;  $p\leq 0.001$ ), and f) businessmen ( $r= 0.72$ ;  $p\leq 0.001$ ). There is no significant association between the journalists' self-rate understanding of science and their assessment of biotechnology as newsworthy.

Factual knowledge of biotechnology<sup>8</sup>. In general, the stakeholders have posted moderate scores on a set of twelve statements that quizzed them on what they know about biotechnology (Table 10a). Low scores range from 0-6, moderate scores are from 7-9, and high scores are from 10-12. The overall mean score on factual knowledge is 7.85.

Among the stakeholders, there are more policy makers ( $47.40\% \pm 5.06$ ) garnering high scores. Policy makers also have the highest mean score of  $8.90 (\pm .232)$ . Extension workers have mean score of  $8.64 (\pm .212)$ , with  $41.30\% (\pm 5.13)$  getting high scores. Businessmen have a mean score of  $7.90 (\pm .368)$ , and farmer leaders have obtained an average score of  $7.21 (\pm .324)$ . There are far less farmer leaders ( $12.30\%, \pm 4.35$ ) than businessmen ( $24.10\% \pm 5.82$ ) obtaining lower scores, however.

Consumers and journalists are not that far behind in terms of mean scores on factual knowledge at  $7.88 (\pm .152)$  and  $7.84 (\pm .367)$  respectively. More or less 60% of the consumers and journalists have moderate scores.

Compared to other stakeholders, religious leaders have not fared as well in terms of factual knowledge on biotechnology. They have the lowest mean score at  $6.58 (\pm .312)$ . Only  $1.80\% (\pm 1.77)$  has shown high scores and nearly 40% have low scores. Not surprisingly, there is a strong association between their factual knowledge of biotechnology and their self-rated knowledge on biotechnology ( $r= 0.39$ ;  $p\leq 0.01$ ).

Strong and significant correlations have been noted in Table 10b between self-rating on knowledge of biotechnology and factual knowledge on biotechnology among policy makers

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<sup>8</sup> The factual knowledge measure consisted of twelve (12) statements answerable by True, False, or Don't Know. The highest score each respondent could get was 12 and lowest was 0. These 12 statements were tested for their reliability or internal consistency. Reliability analysis or test of consistency between each of these 12 statements yielded a reliability alpha coefficient of .7006 at .000 level of significance.

( $r=0.53$ ;  $p \leq 0.001$ ) and businessmen ( $r=0.56$ ;  $p \leq 0.001$ ). On the other hand, there is no correlation between the extension workers' self-rate knowledge of biotechnology and their factual knowledge scores ( $p > 0.05$ ).

There is a significant relationship between journalists' self-rate knowledge of biotechnology and their assessment of the newsworthiness of biotechnology ( $r=0.38$ ;  $p \leq 0.01$ ).

*TABLE 10A: FACTUAL KNOWLEDGE OF BIOTECHNOLOGY  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)*

Stakeholder (n=606)	Mean score ( $\pm$ s.e., max 12)	Low (0-6)	Moderate (7-9)	High (10-12)
Consumers (169)	7.88 $\pm$ .152 <sup>b,c</sup>	18.90 $\pm$ 3.01	63.90 $\pm$ 3.69	17.15 $\pm$ 2.89 <sup>j</sup>
Businessmen (54)	7.90 $\pm$ .368 <sup>b,c</sup>	24.10 $\pm$ 5.82	50.00 $\pm$ 6.80	25.92 $\pm$ 5.96 <sup>f,j</sup>
Extension Workers (92)	8.64 $\pm$ .212 <sup>a,b</sup>	17.39 $\pm$ 3.95	41.30 $\pm$ 5.13	41.30 $\pm$ 5.13 <sup>f,p</sup>
Farmer Leaders (57)	7.21 $\pm$ .324 <sup>c</sup>	12.30 $\pm$ 4.35	54.40 $\pm$ 6.59	33.40 $\pm$ 6.24 <sup>b,e</sup>
Religious Leaders (56)	6.58 $\pm$ .312	39.20 $\pm$ 6.52	58.90 $\pm$ 6.57	1.80 $\pm$ 1.77
Journalists (44)	7.84 $\pm$ .367 <sup>b,c</sup>	13.63 $\pm$ 5.17	59.09 $\pm$ 7.41	18.18 $\pm$ 5.81 <sup>c,b</sup>
Policy Makers (97)	8.90 $\pm$ .232 <sup>a</sup>	11.40 $\pm$ 3.22	41.20 $\pm$ 4.99	47.40 $\pm$ 5.06 <sup>e</sup>
Scientists (37)	Not asked			

*TABLE 10B: CORRELATION BETWEEN FACTUAL KNOWLEDGE OF  
BIOTECHNOLOGY AND KEY VARIABLES  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)*

Stakeholder (n=606)	Knowledge & Interest	Knowledge & Concern	Knowledge & Perceived Risks	Knowledge & Perceived Benefits	Knowledge & Perceived role of science
Consumers (169)	0.22548 <sup>a</sup>	0.17387 <sup>b</sup>	-0.06255	0.19415 <sup>b</sup>	0.14645
Businessmen (54)	<b>0.44884<sup>a</sup></b>	0.16713	<b>-0.45713<sup>a</sup></b>	<b>0.55415<sup>a</sup></b>	0.32103
Extension Workers (92)	<b>0.40059<sup>a</sup></b>	0.07941	-0.06496	0.22525 <sup>c</sup>	0.23361 <sup>c</sup>
Farmer Leaders (57)	-0.09752	0.00621	-0.11858	0.25093	0.12744
Religious Leaders (56)	<b>0.35234<sup>b</sup></b>	<b>0.36034<sup>b</sup></b>	0.00862	<b>0.43624<sup>a</sup></b>	<b>0.56414<sup>a</sup></b>
Journalists (44)	0.28847	0.09501	<b>0.33734<sup>c</sup></b>	0.20436	<b>0.48502<sup>a</sup></b>
Policy Makers (97)	<b>0.36517<sup>a</sup></b>	0.11255	-0.14872	<b>0.37326<sup>a</sup></b>	0.14047

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

Looking into the relationship between factual knowledge and some key variables, the results suggest that there seems to be a pattern of association between factual knowledge and interest in biotechnology as well as between factual knowledge and perceived benefits. Fairly strong and

significant correlations can be noted between factual knowledge and the degree of interest as well as between factual knowledge and perceived benefits among businessmen, extension workers, religious leaders, and policy makers. The results signify that as stakeholders gain more knowledge about biotechnology, there is presumably increased appreciation or recognition of its possible benefits.

#### ***F. Attitudes towards biotechnology***

Attitudes toward agricultural biotechnology<sup>9</sup>. In general, Philippine stakeholders hold a rather moderate stance on biotechnology (Table 11a), with an overall attitude mean score of 60.36. Attitudinal scores have been classified as low (negative), moderate, and high (positive). High scores are in the range of 76-100, moderate scores are between 51-75, and low scores are from 25-50. Very few stakeholders exhibit high attitudinal scores that are indicative of positive feelings or opinions about biotechnology. The individual mean scores may be more accurate in showing where the stakeholders' positions are vis-à-vis biotechnology.

Policy makers have posted the highest mean score of 62.74 ( $\pm 1.39$ ), followed by extension workers ( $\bar{x}=61.01 \pm 1.48$ ), consumers ( $\bar{x}=60.66 \pm .908$ ), businessmen ( $\bar{x}=59.48 \pm 2.92$ ), and journalists ( $\bar{x}=57.68 \pm 3.06$ ).

Comparatively lower mean scores can be noted among religious leaders ( $\bar{x}=54.62 \pm 1.93$ ) and farmer leaders ( $\bar{x}=56.43 \pm 2.34$ ). Religious leaders also have the most number of respondents (28.50%,  $\pm 6.03$ ) who tend to have negative feelings towards agricultural biotechnology.

There is a significant relationship between the journalists' attitude towards biotechnology and their assessment of biotechnology as a news story ( $r=0.31$ ;  $p \leq 0.05$ ).

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<sup>9</sup> Measuring attitudes towards biotechnology consisted of twenty-five (25) questionnaire items. Respondents were asked to choose an answer from a four-point scale ranging from Strongly Agree (4) to Strongly Disagree (1) or Don't Know. Attitude scores ranged from 100 (highest, most positive) to 25 (lowest, least positive). These 25 statements were tested for their reliability or internal consistency. Reliability analysis or test of consistency between each of these 25 statements yielded a reliability alpha coefficient of .8934 at .000 level of significance.

TABLE 11A: ATTITUDES TOWARDS BIOTECHNOLOGY  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean score ( $\pm$ s.e, max 100)	Low (25-50)	Moderate (51-75)	High (76-100)
Consumers (169)	60.66 $\pm$ .908 <sup>ab</sup>	13.60 $\pm$ 2.63	82.80 $\pm$ 2.90	2.40 $\pm$ 1.17 <sup>b,f,r</sup>
Businessmen (54)	59.48 $\pm$ 2.92 <sup>ab</sup>	14.81 $\pm$ 4.83	74.07 $\pm$ 5.96	7.40 $\pm$ 3.56 <sup>c,e,f</sup>
Extension Workers (92)	61.01 $\pm$ 1.48 <sup>ab</sup>	19.60 $\pm$ 4.13	67.30 $\pm$ 4.89	11.95 $\pm$ 3.38 <sup>b,j,p</sup>
Farmer Leaders (57)	56.43 $\pm$ 2.34 <sup>b</sup>	12.20 $\pm$ 4.33	79.00 $\pm$ 5.39	3.50 $\pm$ 6.31 <sup>c,b,r</sup>
Religious Leaders (56)	54.62 $\pm$ 1.93	28.50 $\pm$ 6.03	67.90 $\pm$ 6.23	- 0 -
Journalists (44)	57.68 $\pm$ 3.06 <sup>ab</sup>	22.72 $\pm$ 6.31	56.81 $\pm$ 7.46	13.63 $\pm$ 5.17 <sup>c</sup>
Policy Makers (97)	62.74 $\pm$ 1.39 <sup>a</sup>	13.40 $\pm$ 3.45	70.10 $\pm$ 4.64	15.00 $\pm$ 3.62 <sup>c,b,e,f,r,j,p,s</sup>
Scientists (37)	Not asked			

TABLE 11B: CORRELATION BETWEEN ATTITUDES ON  
BIOTECHNOLOGY AND KEY VARIABLES  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)

Stakeholder (n=606)	Attitude & Interest	Attitude & Concern	Attitude & Perceived Risks	Attitude & Perceived Benefits	Attitude & Factual knowledge	Attitude & Perceived role of science
Consumers (169)	0.21419 <sup>b</sup>	0.20316 <sup>b</sup>	-0.12974	<b>0.34933<sup>a</sup></b>	0.28533 <sup>a</sup>	0.00393
Businessmen (54)	0.06119	0.13387	0.14429	0.25867	0.02116	0.04884
Extension Workers (92)	<b>0.37108<sup>a</sup></b>	0.18727	-0.21297	0.29938 <sup>b</sup>	<b>0.34265<sup>b</sup></b>	0.08416
Farmer Leaders (57)	0.01448	-0.09325	-0.09247	0.21107	<b>0.48804<sup>a</sup></b>	-0.13660
Religious Leaders (56)	<b>0.50119<sup>a</sup></b>	0.33575	-0.10988	<b>0.64061<sup>a</sup></b>	<b>0.45100<sup>a</sup></b>	<b>0.44441<sup>a</sup></b>
Journalists (44)	<b>0.32657<sup>c</sup></b>	-0.05300	<b>0.51284<sup>a</sup></b>	<b>0.33397<sup>c</sup></b>	<b>0.45672<sup>a</sup></b>	<b>0.49327<sup>a</sup></b>
Policy Makers (97)	<b>0.41043<sup>a</sup></b>	0.22533	<b>-0.29226<sup>b</sup></b>	<b>0.33895<sup>a</sup></b>	<b>0.32767<sup>b</sup></b>	0.22015 <sup>c</sup>

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

In general, attitudes towards biotechnology are associated with factual knowledge on biotechnology (Table 11b). Significant correlations between attitude and factual knowledge can be observed among extension workers, farmer leaders, religious leaders, journalists, and policy makers. In a sense, it can be said that among the stakeholders just mentioned, having high factual knowledge about biotechnology is related having a positive attitude as well towards biotechnology and vice-versa.

Likewise, positive attitude is also related to being highly interested in biotechnology and perceiving it to have high benefits. Significant correlations between attitude and each of these two variables can be noted among consumers, extension workers, religious leaders, journalists, and policy makers. There is also a relationship between positive attitude and the perception of science as having a key part in agricultural development. These significant associations between attitudes and science can be seen among religious leaders, journalists, and policy makers. Concern about biotechnology issues does not seem to be associated with having positive attitudes towards biotechnology, except among consumers albeit a weak correlation.

These attitudinal scores, however, are a composite of twenty-five questionnaire items. How the Philippine stakeholders have responded to specific questionnaire items may provide more much more useful and revealing insights about their positions in relation to agricultural biotechnology. The following data looks at stakeholders' responses to specific issues such as labeling, banning, costs, and benefits of genetically modified foods.

a) I will contribute time and money to ban GM foods. Definitely banning GM foods and getting involved in banning activities that involve time and money is not for Philippine policy makers, businessmen, and extension workers. About 75% ( $\pm 4.37$ ) of policy makers disagree with the notion of contributing their own resources to ban GM foods (Table 12). A considerable number of businessmen (66.60%,  $\pm 6.41$ ) and extension workers (66.30%,  $\pm 4.92$ ) are not in favor of being actively involved in banning GM foods. These patterns are evident in the mean scores, where policy makers, businessmen and extension workers show higher mean scores than the rest which signify the tendency to disagree with the notion of banning GM foods.

Philippine consumers are rather ambivalent or split about the issue of banning GM foods. A little over half of farmer leaders and journalists also do not believe in contributing time and money to ban GM foods.

The Philippine stakeholder group that manifests the highest interest to ban GM foods altogether is the religious leaders ( $\bar{x}=1.80 \pm .156$ ). A little over half of the religious leaders surveyed (51.80%,  $\pm 6.67$ ) say that they will contribute time and money to ban GM foods.

TABLE 12: I WILL CONTRIBUTE MONEY & TIME TO BAN GM FOODS.  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)<sup>10</sup>

Stakeholder (n=606)	Mean score ( $\pm$ s.e, max 4)*	Agree	Disagree
Consumers (169)	2.21 $\pm$ .083	46.70 $\pm$ 3.83 <sup>b,e,f,j,p</sup>	41.40 $\pm$ 3.78
Businessmen (54)	2.54 $\pm$ .206	14.80 $\pm$ 4.83 <sup>c,r,j</sup>	66.60 $\pm$ 6.41
Extension Workers (92)	2.55 $\pm$ .133	19.50 $\pm$ 4.13 <sup>c,r</sup>	66.30 $\pm$ 4.92
Farmer Leaders (57)	2.12 $\pm$ .181	22.90 $\pm$ 5.56 <sup>c,b,r</sup>	52.60 $\pm$ 6.60
Religious Leaders (56)	1.80 $\pm$ .156	51.80 $\pm$ 6.67 <sup>b,e,f,j,p</sup>	26.80 $\pm$ 5.91
Journalists (44)	2.36 $\pm$ .223	27.20 $\pm$ 6.70 <sup>c,b,e,r</sup>	52.20 $\pm$ 7.53
Policy Makers (97)	2.76 $\pm$ .120	21.70 $\pm$ 4.18 <sup>c,r</sup>	75.30 $\pm$ 4.37
Scientists (37)	Not asked		

b) GM foods should be labeled. Philippine stakeholders are rather unanimous about labeling GM foods (Table 13). No less than 60% of all the respondents surveyed across stakeholder groups believe that GM foods should be labeled. In particular, a very clear majority of extension workers (95%,  $\pm$  2.13), consumers (95.30%,  $\pm$  1.62), and religious leaders (94.60%,  $\pm$  3.02) totally agree with the concept of labeling GM foods.

On the other hand, at least one-third of the policy makers surveyed (33.0%,  $\pm$  4.77) and 22.20% ( $\pm$  5.65) of the businessmen have expressed disagreement about labeling. These results should not really prove surprising. Labeling has always been associated with the citizens' right to choose and know about the food they eat.

TABLE 13: GM FOODS SHOULD BE LABELED.  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean score ( $\pm$ s.e, max 4)	Agree	Disagree
Consumers (169)	3.27 $\pm$ .055	95.30 $\pm$ 1.62 <sup>b,f,j,p</sup>	3.00 $\pm$ 1.31
Businessmen (54)	3.14 $\pm$ .197	74.00 $\pm$ 5.96 <sup>c,e,r,f,j,p</sup>	22.20 $\pm$ 5.65
Extension Workers (92)	3.47 $\pm$ .073	95.60 $\pm$ 2.13 <sup>b,f,j,p</sup>	3.30 $\pm$ 1.86
Farmer Leaders (57)	3.14 $\pm$ .149	86.00 $\pm$ 4.59 <sup>c,b,e,r,j,p</sup>	7.00 $\pm$ 3.37
Religious Leaders (56)	3.44 $\pm$ .113	94.60 $\pm$ 3.02 <sup>b,f,j,p</sup>	1.80 $\pm$ 1.77
Journalists (44)	1.34 $\pm$ .125	81.80 $\pm$ 5.81 <sup>c,b,e,f,r,p</sup>	6.80 $\pm$ 3.79
Policy Makers (97)	2.60 $\pm$ .113	61.80 $\pm$ 4.93 <sup>c,b,e,f,r,j</sup>	33.00 $\pm$ 4.77
Scientists (37)	Not asked		

<sup>10</sup> Reversed scale: 1= Strongly agree, 2= Agree, 3=Disagree, 4=Strongly disagree. Also, note that percentages may not add up to 100% as "Don't Know" and "Not Sure" responses are not included.

c) Agricultural biotechnology will not benefit small farmers. No less than 56% Philippine stakeholders, except religious leaders, disagree with the notion that agricultural biotechnology will not benefit small farmers. Seventy-nine percent ( $\pm 4.10$ ) of the policy makers have expressed disagreement together with 77.20% ( $\pm 4.37$ ) of extension workers, and 69.80% ( $\pm 3.53$ ) of consumers.

On the other hand, even religious leaders are quite divided in this issue, with nearly 45% saying they disagree and 39.20% ( $\pm 6.52$ ) saying that biotechnology will definitely not bring anything good to Philippine farmers (Table 14).

*TABLE 14: AGRICULTURAL BIOTECHNOLOGY WILL NOT BENEFIT SMALL FARMERS.  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)*

<i>Stakeholder (n=606)</i>	<i>Mean score (<math>\pm</math> s.e, max 4)*</i>	<i>Agree</i>	<i>Disagree</i>
Consumers (169)	2.54 $\pm$ .112	21.90 $\pm$ 3.18 <sup>e,r</sup>	69.80 $\pm$ 3.53
Businessmen (54)	2.40 $\pm$ .298	22.20 $\pm$ 5.65 <sup>e,r</sup>	59.20 $\pm$ 6.68
Extension Workers (92)	2.70 $\pm$ .103	15.30 $\pm$ 3.75 <sup>c,b,f,r,j,p</sup>	77.20 $\pm$ 4.37
Farmer Leaders (57)	2.19 $\pm$ .168	26.30 $\pm$ 5.83 <sup>e,r,p</sup>	56.20 $\pm$ 6.57
Religious Leaders (56)	2.00 $\pm$ .165	39.20 $\pm$ 6.52 <sup>c,b,f,j,p</sup>	44.60 $\pm$ 6.64
Journalists (44)	2.63 $\pm$ .184	20.40 $\pm$ 6.07 <sup>e,r</sup>	68.20 $\pm$ 7.02
Policy Makers (97)	3.00 $\pm$ .102	15.50 $\pm$ 3.67 <sup>e,f,r</sup>	79.40 $\pm$ 4.10
Scientists (37)	Not asked		

\* *Reversed scale: 1= Strongly agree, 2= Agree, 3=Disagree, 4=Strongly disagree*

d) Biotechnology is good for Philippine agriculture. At least 50% of the respondents across stakeholders agree with the idea that biotechnology is good for Philippine agriculture, in general. (Table 15). Around 78% ( $\pm 4.17$ ) each of policy makers and businessmen ( $\pm 5.56$ ), and 70.70% ( $\pm 4.74$ ) of extension workers have very positive thoughts about the value of agricultural biotechnology in the country.

Nearly one-third of the Philippine consumers surveyed have expressed some disagreements, but most noticeable is the ambivalence shown by religious leaders on whether or not biotechnology will benefit Philippine agriculture overall.

TABLE 15: BIOTECHNOLOGY IS GOOD FOR PHILIPPINE AGRICULTURE.  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean score ( $\pm$ s.e, max 4)	Agree	Disagree
Consumers (169)	2.55 $\pm$ .081	59.20 $\pm$ 3.78 <sup>b,e,p</sup>	32.00 $\pm$ 3.58
Businessmen (54)	2.62 $\pm$ .262	77.80 $\pm$ 5.65 <sup>c,f,r</sup>	3.70 $\pm$ 2.56
Extension Workers (92)	2.53 $\pm$ .140	70.70 $\pm$ 4.74 <sup>c,r</sup>	10.90 $\pm$ 3.24
Farmer Leaders (57)	2.31 $\pm$ .182	63.10 $\pm$ 6.39 <sup>b,r,p</sup>	14.00 $\pm$ 4.59
Religious Leaders (56)	2.10 $\pm$ .179	51.80 $\pm$ 6.67 <sup>b,e,f,j,p</sup>	23.20 $\pm$ 5.64
Journalists (44)	2.56 $\pm$ .196	68.20 $\pm$ 7.02 <sup>p</sup>	18.20 $\pm$ 5.81
Policy Makers (97)	2.83 $\pm$ .106	78.40 $\pm$ 4.17 <sup>c,f,r,j</sup>	14.40 $\pm$ 3.56
Scientists (37)	Not asked		

e) Current biotechnology regulations in the Philippines are sufficient. Most of the Philippine stakeholders are rather divided in this issue (Table 16). Only a marginal majority among businessmen (55.50%,  $\pm$  6.76) believes that current biotechnology regulations in the Philippines are sufficient. Policy makers, on the other hand, think that the regulations are quite inadequate.

The consumers' mean score ( $\bar{x}$ =2.41,  $\pm$  .081) is only slightly higher than that of the businessmen. However, they also consumers seem to be rather undecided about this issue on the adequacy of regulations. Similar near-splits are noticeable among extension workers, farmer leaders, and journalists if standard errors are considered. Religious leaders are clearly split two ways on the issue.

TABLE 16: CURRENT BIOTECHNOLOGY REGULATIONS IN THE PHILIPPINES ARE SUFFICIENT.  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean score ( $\pm$ s.e, max 4)	Agree	Disagree
Consumers (169)	2.41 $\pm$ .081	49.10 $\pm$ 3.84 <sup>f,r,p</sup>	42.10 $\pm$ 3.79
Businessmen (54)	2.25 $\pm$ .248	55.50 $\pm$ 6.76 <sup>e,f,r,j,p</sup>	25.90 $\pm$ 5.96
Extension Workers (92)	2.15 $\pm$ .134	45.60 $\pm$ 5.19 <sup>f</sup>	34.70 $\pm$ 4.96
Farmer Leaders (57)	1.78 $\pm$ .171	31.60 $\pm$ 6.15 <sup>c,b,j</sup>	40.30 $\pm$ 6.49
Religious Leaders (56)	1.85 $\pm$ .165	37.50 $\pm$ 6.46 <sup>c,b</sup>	37.50 $\pm$ 6.46
Journalists (44)	2.09 $\pm$ .210	45.40 $\pm$ 7.50	31.80 $\pm$ 7.02
Policy Makers (97)	2.05 $\pm$ .108	38.10 $\pm$ 4.93 <sup>b,c</sup>	49.50 $\pm$ 5.07
Scientists (37)	Not asked		

f) I will pay extra cost for labeling GM foods. Across stakeholders, there is strong agreement on the notion that GM foods should be labeled (Table 13). However, it is a different issue

altogether when asked if they are willing to pay the extra cost for labeling GM food (Table 17). There is on average a 30-point drop in the percentage of respondents willing to support the notion of paying up for the extra cost for labeling GM foods.

Among consumers, farmer leaders, and religious leaders, for example, who have expressed overwhelming support for labeling GM foods, those numbers down to 47.90% ( $\pm 3.84$ ), 50.90% ( $\pm 6.62$ ), and 66.10% ( $\pm 6.32$ ) respectively. Nonetheless, these three stakeholders appear to continue support labeling even if it means paying for it. Majority of the journalists, however, say that will not pay extra for the labeling of food.

TABLE 17: I WILL PAY EXTRA COST FOR LABELING GM FOOD.  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean score ( $\pm$ s.e, max 4)	Agree	Disagree
Consumers (169)	2.31 $\pm$ .078	47.90 $\pm$ 3.84 <sup>f,j</sup>	43.80 $\pm$ 3.81
Businessmen (54)	2.14 $\pm$ .236	51.80 $\pm$ 6.79 <sup>f,j,p</sup>	33.30 $\pm$ 6.41
Extension Workers (92)	2.10 $\pm$ .140	46.70 $\pm$ 5.20 <sup>f,j</sup>	34.60 $\pm$ 4.95
Farmer Leaders (57)	2.33 $\pm$ .142	50.90 $\pm$ 6.62 <sup>f,j,p</sup>	38.60 $\pm$ 6.44
Religious Leaders (56)	2.46 $\pm$ .161	66.10 $\pm$ 6.32 <sup>c,b,e,f,r,p,s</sup>	19.70 $\pm$ 5.31
Journalists (44)	2.04 $\pm$ .177	34.10 $\pm$ 7.14 <sup>c,b,e,f,r</sup>	52.20 $\pm$ 7.53
Policy Makers (97)	2.42 $\pm$ .113	38.10 $\pm$ 4.93 <sup>b,f,r</sup>	49.50 $\pm$ 5.07
Scientists (37)	Not asked		

#### H. Information sources: Use, Exposure, and Trust

Types and frequency of media used. The surveys asked respondents about their sources of information on biotechnology and what sources of information they trust most. In general, Philippine stakeholders exhibit between low to moderate information seeking behaviors on matters relating to biotechnology (Table 18a). Looking at the top three most frequently used or consulted information sources of the eight stakeholders<sup>11</sup>, survey results show that consumers tend to receive information about biotechnology from a) general mass media (i.e., radio, television, and newspapers, b) family, friends, or colleagues, and c) experts.

<sup>11</sup> The top three choices of each stakeholder are first determined to identify the common choices (Table 18a).

It must be noted that less than 20% of Philippine consumers have used information from these sources at least three times within a two-month period. Moreover, the average frequency of contact consumers have had with these media within a two-month period is extremely low (Table 18b). On the average, consumers have used the tri-media sources 1.53 times ( $\pm .068$ ), family and other proximate interpersonal sources practically only once ( $\bar{x}=1.05 \pm .076$ ), and experts more or less four times ( $\bar{x}=3.70 \pm .306$ ).

Ten percent of the consumers surveyed have reported accessing websites on biotechnology and 11.80% have claimed to reading or using newsletters, pamphlets, or brochures for information on biotechnology. Consumers have barely talked to a religious group or a local politician about biotechnology.

Relative to other stakeholders, businessmen, journalists, and policy makers display comparatively active information seeking behaviors. About 40 percent ( $\pm 6.69$ ) of businessmen claim that they have talked to or consulted with experts or scientists about biotechnology at least three times within a two-month period. Nearly 29 percent ( $\pm 6.21$ ) say that they have also received biotechnology information via radio, television, and newspapers, and 27.80% ( $\pm 6.10$ ) have mentioned using special media such as brochures, pamphlets, and newsletters to get information about biotechnology.

About 45.50 percent ( $\pm 7.51$ ) of the journalists surveyed report having used the tri-media to get or receive information on biotechnology at least three times within a two-month period. Nearly 34.10 percent ( $\pm 7.15$ ) claim to have talked to experts, professionals, and scientists about the topic, and 25.00% ( $\pm 6.53$ ) have read books on biotechnology. The top choices of information on biotechnology for most policy makers (34.00%,  $\pm 4.81$ ) are experts, scientists, and other professionals (33.00%,  $\pm 4.77$ ), and possibly colleagues (27.80%,  $\pm 4.55$ ).

Religious leaders seek information on biotechnology the least. Barely 20% of religious leaders have used or received information on biotechnology from the general mass media. Only 8.90% ( $\pm 3.81$ ) say that they have talked to an expert or a professional about biotechnology and another 8.90% ( $\pm 3.81$ ) claim to have talked to their colleagues or peers about the topic.

Overall, the most frequently used sources of information on biotechnology by Philippine stakeholders are: a) radio, television, and newspapers and b) experts/professionals or scientists. Special groups like NGOs, government regulators, political leaders, agri-biotech companies, or

religious groups are not as widely consulted and neither are specialized media like public forums or seminars and websites.

Table 18b shows the average number within a two-month period that each of the stakeholders has used or received information from aggregate information sources. These aggregate sources are classified as a) general mass media contacts, b) proximate interpersonal contacts, c) special media contacts, and d) special interpersonal contacts.

Evidently, journalists, policy makers, businessmen, and extension workers have posted the most frequent contacts with special interpersonal sources such as experts, professionals, or scientists. Journalists lead stakeholders in the frequency of using all four categories of information sources to get information on biotechnology. For example, within a two-month period, journalists have talked to specialized information sources at least 7.59 times. Businessmen have sought information from these sources at least 7.29 times while policy makers have done so for at least 7.12 times. Information from these special information sources is evidently vital to the work of these three stakeholders. On the other hand, policy makers rank first in terms of the number of times they have sought information on biotechnology from specialized media such as books, websites, newsletters, or pamphlets.

Philippine scientists rank fifth both in the frequency of use of special interpersonal sources ( $5.94 \pm .799$ ) and special media ( $3.18 \pm .456$ ). Consumers and religious leaders rank seventh and eighth respectively in the frequency of use of all four categories of information sources.

TABLE 18A: INFORMATION SOURCES USED<sup>12</sup>  
(PERCENTAGE REPORT ON HIGHEST USAGE ONLY)

Information Sources used	Stakeholder							
	Consumers	Businessmen	Extension workers	Farmer leaders	Religious leaders	Journalists	Policy makers	Scientists
Tri-media	<b>18.40</b> <sup>b,j</sup> ±2.98	<b>29.60</b> <sup>c,e,r,j</sup> ±6.21	<b>17.40</b> <sup>b,j</sup> ±3.95	<b>22.80</b> <sup>j</sup> ±5.56	<b>19.60</b> <sup>b,j</sup> ±5.31	<b>45.50</b> <sup>c,b,e,f,r,p,s</sup> ±7.51	25.80 <sup>j</sup> ±4.44	<b>24.40</b> <sup>j</sup> ±7.06
Family/Friends	<b>13.60</b> <sup>i,p,s</sup> ±2.64	16.60 <sup>i,p</sup> ±5.06	15.20 <sup>j,p,s</sup> ±3.74	<b>17.50</b> <sup>r,j,p</sup> ±5.03	<b>8.90</b> <sup>f,j,p,s</sup> ±3.81	31.80 <sup>c,b,e,f,r</sup> ±7.02	<b>27.80</b> <sup>c,b,e,f,r</sup> ±4.55	24.30 <sup>c,e,r</sup> ±7.05
Religious groups	0.60 <sup>b,j,p</sup> ±0.59	5.50 <sup>c</sup> ±3.10	4.30 <sup>j</sup> ±2.12	3.50 <sup>j</sup> ±2.43	3.50 <sup>j</sup> ±2.46	9.10 <sup>c,e,f,r</sup> ±4.34	6.20 <sup>c</sup> ±2.45	0
Experts	<b>17.70</b> <sup>b,r,j,p,s</sup> ±2.94	<b>40.80</b> <sup>c,e,f,r</sup> ±6.69	<b>20.70</b> <sup>b,f,r,j,p,s</sup> ±4.22	<b>10.50</b> <sup>b,e,j,p,s</sup> ±4.06	<b>8.90</b> <sup>b,e,j,p,s</sup> ±3.81	<b>34.10</b> <sup>c,e,f,r</sup> ±7.15	<b>34.00</b> <sup>c,e,f,r</sup> ±4.81	<b>35.20</b> <sup>c,e,f,r</sup> ±7.85
NGOs	4.10 <sup>b,p,s</sup> ±1.53	14.80 <sup>c,e,f,r</sup> ±4.83	7.60 <sup>b</sup> ±2.76	3.50 <sup>b,p,s</sup> ±2.43	8.90 <sup>b</sup> ±3.81	9.10 ±4.34	10.30 <sup>e,f</sup> ±3.09	10.80 <sup>e,f</sup> ±5.10
Politicians	1.80 ±1.02	5.60 ±3.13	1.10 ±1.09	3.50 ±2.43	1.70 ±1.78	4.60 ±3.16	6.20 ±2.45	2.70 ±2.67
Websites	10.00 <sup>b,p</sup> ±2.31	24.00 <sup>c,e,f,j,s</sup> ±5.81	5.40 <sup>b,j,p</sup> ±2.36	7.00 <sup>b,j,p</sup> ±3.38	0	15.90 <sup>b,e,f,s</sup> ±5.51	21.70 <sup>c,e,f,s</sup> ±4.19	8.10 <sup>b,j,p</sup> ±4.49
Books	6.00 <sup>b,j,p,s</sup> ±1.83	14.80 <sup>c,f,r,j,p</sup> ±4.83	10.80 <sup>f,r,j,p</sup> ±3.24	3.60 <sup>f,j,p,s,f</sup> ±2.47	3.50 <sup>f,e,j,p,s</sup> ±2.46	<b>25.00</b> <sup>c,b,e,f,r,s</sup> ±6.53	28.80 <sup>c,b,e,f,r,s</sup> ±4.60	13.50 <sup>c,f,r,j,p</sup> ±5.62
Pamphlets	11.80 <sup>b,r,j,p,s</sup> ±2.48	<b>27.80</b> <sup>c,e,f,r</sup> ±6.10	<b>18.50</b> <sup>b,r,j,p,s</sup> ±4.05	14.10 <sup>b,r,j,p,s</sup> ±4.61	3.50 <sup>c,b,e,j,p,s</sup> ±2.46	27.30 <sup>c,e,e,f,r</sup> ±6.72	<b>33.00</b> <sup>c,e,f,r</sup> ±4.77	<b>29.70</b> <sup>c,e,f,r</sup> ±7.51
Regulators	4.80 <sup>b</sup> ±1.64	12.90 <sup>c,e,s</sup> ±4.56	3.30 <sup>b,p</sup> ±4.90	0	0	9.10 <sup>s</sup> ±4.34	10.30 <sup>e,s</sup> ±3.09	2.70 <sup>b,j,p</sup> ±2.67
Seminars	4.80 <sup>b,j,p</sup> ±1.64	12.90 <sup>c,j,p</sup> ±4.56	8.70 <sup>j,p</sup> ±2.94	0	0	18.10 <sup>c,e</sup> ±5.80	17.50 <sup>c,e</sup> ±3.86	13.50 <sup>c</sup> ±5.62
Ag companies	6.50 <sup>b,j</sup> ±1.90	18.50 ±5.28	9.80 <sup>b,r,j,s</sup> ±3.10	5.30 <sup>b,j,p</sup> ±2.97	3.50 <sup>b,f,j,p</sup> ±2.46	20.40 <sup>c,e,f,r,p,s</sup> ±6.08	12.30 <sup>f,r,j,s</sup> ±3.34	2.70 <sup>b,e,j,p</sup> ±2.67

<sup>12</sup> The respondents were asked how often they have used an information source within the past two months. Responses have ranged from 0 through 3 or more times during the past two months. The percentages reported in this table reflect the number of stakeholders using an information source 3 or more times during the past two months. The top three information sources of each stakeholder are in bold.

*TABLE 18B: CATEGORIZED INFORMATION SOURCES USED*<sup>13</sup>  
(AVERAGE NUMBER OF TIMES SOURCES WERE USED WITHIN THE PAST TWO MONTHS)

Stakeholder (n=606)	General media (Max. = 3)	Proximate interpersonal contacts (Max. = 3)	Special media contacts (Max. = 9)	Special interpersonal contacts (Max. = 21)
Consumers	1.53 ± .068	1.05 ± .076	2.12 ± .183	3.70 ± .306
Businessmen	1.62 ± .147	1.33 ± .144	3.77 ± .398	7.29 ± .758
Extension Workers	1.42 ± .103	1.47 ± .097	3.04 ± .229	6.13 ± .459
Farmer Leaders	1.45 ± .148	1.26 ± .136	2.38 ± .303	5.35 ± .553
Religious Leaders	1.41 ± .143	0.92 ± .127	1.92 ± .259	3.57 ± .499
Journalists	2.02 ± .160	1.68 ± .171	3.77 ± .459	7.59 ± .812
Policy Makers	1.68 ± .102	1.65 ± .103	4.09 ± .303	7.12 ± .501
Scientists	1.67 ± .177	1.45 ± .180	3.18 ± .456	5.94 ± .799

Significant correlations exist between the uses of these four categories of information sources as shown in Table 18c. Overall, these significant associations imply that those who seek information via the mass media and through familiar sources also tend to get information from other specialized media (e.g., pamphlets, brochures, websites) as well as specialized interpersonal sources such as experts, regulators, and public forums on biotechnology. As stakeholders seek information on biotechnology, any increase in their use of mass media sources also leads to increased usage of interpersonal and social networks.

Table 18d shows significant correlations at  $p \leq 0.01$  between journalists' special interpersonal contacts and factual knowledge on biotechnology ( $r=0.38$ ) as well as special media contacts and factual knowledge on biotechnology ( $r=0.43$ ). Among businessmen, strong associations at  $p \leq .001$  can be noted between special interpersonal contacts and factual knowledge on biotechnology ( $r=0.52$ ) as well as special media contacts and factual knowledge on biotechnology ( $r=0.61$ ). Similar relationships at  $p \leq .001$  exist between policy makers' use of special interpersonal contacts and factual knowledge on biotechnology ( $r=0.35$ ) as well as special media contacts and factual knowledge on biotechnology ( $r=0.37$ ).

<sup>13</sup> General media sources refer to the dominant tri-media, i.e. radio, TV, & newspapers. Proximate interpersonal contacts refer to daily interactions with familial sources such as family, friends, neighbors, & colleagues. Special media contacts (SMC) refer to websites, books, brochures, newsletters, and pamphlets. Special interpersonal contacts (SIC) suggest face-to-face interactions with sources that have specialized information. Frequency of use of special media contacts and special interpersonal contacts implies active information search and usage.

**TABLE 18C: CORRELATION BETWEEN SOURCE CATEGORIES**  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)

Stakeholder (n=606)	General media & Proximate interpersonal contacts	Special media contacts & General media	Special interpersonal contacts & Proximate contacts	Special media & Special interpersonal contacts
Consumers	0.43371 <sup>a</sup>	0.53500 <sup>a</sup>	0.59728 <sup>a</sup>	0.64328 <sup>a</sup>
Businessmen	0.36951 <sup>b</sup>	0.46808 <sup>a</sup>	0.59835 <sup>a</sup>	0.74902 <sup>a</sup>
Extension Workers	0.36063 <sup>a</sup>	0.47591 <sup>a</sup>	0.45441 <sup>a</sup>	0.63221 <sup>a</sup>
Farmer Leaders	0.65450 <sup>a</sup>	0.61258 <sup>a</sup>	0.57849 <sup>a</sup>	0.49116 <sup>a</sup>
Religious Leaders	0.58971 <sup>a</sup>	0.34277 <sup>b</sup>	0.70248 <sup>a</sup>	0.64556 <sup>a</sup>
Journalists	0.55113 <sup>a</sup>	0.29502	0.66656 <sup>a</sup>	0.78054 <sup>a</sup>
Policy Makers	0.57650 <sup>a</sup>	0.57329 <sup>a</sup>	0.54245 <sup>a</sup>	0.81255 <sup>a</sup>
Scientists	0.59800 <sup>a</sup>	0.52545 <sup>a</sup>	0.75063 <sup>a</sup>	0.85658 <sup>a</sup>

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

**TABLE 18D: CORRELATION BETWEEN SPECIAL MEDIA CONTACTS (SMC) AND KEY VARIABLES**  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)

Stakeholder (n=606)	SMC & Interest	SMC & Concern	SMC & Perceived Risks	SMC & Perceived Benefits	SMC & Factual Knowledge	SMC & Attitudes
Consumers	0.11532	0.0865	-0.25541 <sup>a</sup>	0.1805 <sup>c</sup>	0.18168 <sup>c</sup>	0.06427
Businessmen	0.47841 <sup>a</sup>	0.24698 <sup>a</sup>	-0.45696 <sup>a</sup>	0.47038 <sup>a</sup>	0.61430 <sup>a</sup>	0.13597
Extension Workers	0.03134	0.07319	-0.00818	0.07004	0.01508	0.21415 <sup>c</sup>
Farmer Leaders	0.25467	0.30990 <sup>a</sup>	0.12573	0.29833 <sup>a</sup>	0.20367	0.21605
Religious Leaders	0.29888 <sup>c</sup>	0.24029	-0.09630	0.16691	0.33540 <sup>a</sup>	0.38674 <sup>c</sup>
Journalists	0.35031 <sup>c</sup>	0.22225	0.29080	0.36391 <sup>a</sup>	0.42862 <sup>b</sup>	0.50945 <sup>a</sup>
Policy Makers	0.42199 <sup>a</sup>	0.07409	-0.28874 <sup>a</sup>	0.23651 <sup>a</sup>	0.36959 <sup>a</sup>	0.33690 <sup>a</sup>
Scientists	0.39387 <sup>c</sup>	0.63693 <sup>a</sup>	0.38344 <sup>a</sup>	0.45127 <sup>a</sup>	Not asked	Not asked

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

Is the usage of specialized sources of information on biotechnology related to stakeholders' interest, concern, perceptions of risks and benefits, knowledge and attitudes towards biotechnology? Looking at Tables 18d and 18e, it appears that special media and special interpersonal sources have a strong influence on how businessmen, policy makers, scientists, and journalists view biotechnology. It can only mean that active information seeking behaviors via these special channels do have an impact on their assessments of biotechnology. The correlations between their use of special information sources and these key variables merit further examination about the specific types of media, social networks, and information that they seek in order to form their judgments about biotechnology. On the other hand, it should also be considered that these stakeholders are already predisposed to searching for information. Communication interventions

will need to focus on encouraging extension workers, farmer leaders, and consumers to be more attentive to biotechnology issues.

Among businessmen, strong and significant associations exist between their use of special media and their level of interest, perceived benefits and factual knowledge about biotechnology. It shows that the regularity of contact and presumably information search in specialized media have a bearing on how they think about biotechnology. The use of these special media sources particularly influence what they know about biotechnology and is negatively associated with perceived risks of biotechnology suggesting that increased use of special media sources is accompanied by lowered perceptions of the risks of biotechnology. It is weakly related to their personal concern about biotechnology. Similar trends can be noted in the significant relationships between businessmen’s use of special interpersonal contacts and a) interest, b) perceived risks, c) perceived benefits, and d) factual knowledge (Table 18e). However, these two categories of media sources are not associated with their attitudes towards biotechnology ( $p > 0.05$ ).

Special media contacts likewise have a bearing on the level of interest, factual knowledge, and attitudes towards biotechnology held by journalists and policy makers. Very weak correlations can be noted between consumers’ use of special media and interpersonal sources on their interest, concern, and perceived risk of biotechnology. It is interesting to note the strong associations between the scientists’ increased use of biotechnology information from special sources and their concern and perceptions of risks.

*TABLE 18E: CORRELATION BETWEEN SPECIAL INTERPERSONAL CONTACTS (SIC) AND KEY VARIABLES*  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)

Stakeholder (n=606)	SIC & Interest	SIC & Concern	SIC & Perceived Risks	SIC & Perceived Benefits	SIC & Factual Knowledge	SIC & Attitudes
Consumers	0.20089 <sup>b</sup>	0.19230 <sup>c</sup>	-0.19068 <sup>c</sup>	0.19441	<b>0.15467<sup>c</sup></b>	0.05314
Businessmen	<b>0.47541<sup>a</sup></b>	0.32042	<b>-0.43448<sup>a</sup></b>	<b>0.39278<sup>b</sup></b>	<b>0.54780<sup>a</sup></b>	0.18023
Extension Workers	0.09627	0.05757	-0.10686	0.14888	0.08980	0.24765 <sup>a</sup>
Farmer Leaders	<b>0.31268<sup>c</sup></b>	0.20665	-0.02679	<b>0.44387<sup>a</sup></b>	0.11421	0.17862
Religious Leaders	<b>0.31928<sup>c</sup></b>	<b>0.37552<sup>b</sup></b>	0.13597	0.24246	0.19343	0.25229
Journalists	0.36598	0.05560	<b>0.44741<sup>b</sup></b>	0.27096	<b>0.38517<sup>b</sup></b>	0.55954
Policy Makers	<b>0.41578<sup>a</sup></b>	0.09814	-0.32917	0.28702	<b>0.34830<sup>a</sup></b>	<b>0.33948<sup>a</sup></b>
Scientists	<b>0.52513<sup>a</sup></b>	<b>0.67444<sup>a</sup></b>	<b>0.42117<sup>b</sup></b>	<b>0.54350<sup>a</sup></b>	<i>Not asked</i>	<i>Not asked</i>

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

Perceived trust in information sources. University scientists and science magazines rank high among the top three possible sources of information considered as trustworthy by stakeholders (Table 19). Except religious leaders, all stakeholders have cited websites as a trusted source of information on biotechnology.

Religious leaders and farmer leaders have both included NGOs as one of their top three choices of trustworthy information sources.

*TABLE 19: TRUST IN SOURCES OF INFORMATION<sup>14</sup>*  
(PERCENTAGE REPORT ON HIGH TRUST)

Information sources	Stakeholder						
	Consumers	Businessmen	Extension	Farmer leaders	Religious leaders	Journalists	Policy makers
Agri-biotech companies	59.17 <sup>e,f,r,p</sup> ±3.78	50.00 <sup>f,r</sup> ±6.80	28.20 <sup>c,f,r</sup> ±4.69	28.07 <sup>c,b,e,j,p</sup> ±5.95	30.35 <sup>c,b,e,j,p</sup> ±6.14	50.00 <sup>f,r</sup> ±7.54	47.42 <sup>c,f,r</sup> ±5.07
University scientists	<b>72.78<sup>p</sup></b> <b>±3.42</b>	<b>75.92<sup>f,r</sup></b> <b>±5.82</b>	<b>75.00<sup>f,r</sup></b> <b>±4.52</b>	<b>64.91<sup>b,e,r,p</sup></b> <b>±6.32</b>	<b>51.78<sup>c,b,e,f,p</sup></b> <b>±6.68</b>	<b>79.54<sup>f,r</sup></b> <b>±6.08</b>	<b>83.50<sup>c,f,r</sup></b> <b>±3.77</b>
Private sector scientists	55.62 <sup>f,p</sup> ±3.82	59.25 <sup>f,r</sup> ±6.69	<b>53.26<sup>r</sup></b> <b>±5.20</b>	45.61 <sup>b,j,p</sup> ±6.60	39.28 <sup>c,b,e,j,p</sup> ±6.53	65.90 <sup>c,e,f,r</sup> ±7.15	68.04 <sup>c,e,f,r</sup> ±4.74
Television	33.70 <sup>f,j,p</sup> ±3.64	40.74 <sup>j</sup> ±6.69	35.86 <sup>j,p</sup> ±4.94	45.61 <sup>c,e</sup> ±6.60	39.28 <sup>j</sup> ±6.53	52.27 <sup>c,b,e,r</sup> ±7.53	47.42 <sup>c,e</sup> ±5.07
Radio	33.13 <sup>j</sup> ±3.62	31.48 <sup>j</sup> ±6.32	34.78 <sup>j</sup> ±4.97	38.59 <sup>j</sup> ±6.45	35.71 ±6.40	52.27 <sup>c,b,e,f,r</sup> ±7.53	42.26 <sup>b</sup> ±5.02
Newspapers	39.04 <sup>b,f,j</sup> ±3.75	53.70 <sup>c</sup> ±6.79	47.82 ±5.21	50.87 <sup>c</sup> ±6.62	44.64 <sup>j</sup> ±6.64	<b>56.81<sup>c,r,p</sup></b> <b>±7.47</b>	46.39 ±5.06
Websites	<b>59.76<sup>p</sup></b> <b>±3.77</b>	<b>62.96<sup>f,r,p</sup></b> <b>±6.58</b>	<b>53.26<sup>r,p</sup></b> <b>±5.20</b>	<b>52.63<sup>r,p</sup></b> <b>±6.61</b>	32.14 <sup>c,b,e,f,j,p,s</sup> ±6.24	<b>56.81<sup>r,p</sup></b> <b>±7.47</b>	<b>74.22<sup>c,b,e,f,r,j,p</sup></b> <b>±4.44</b>
Religious groups	37.86 <sup>b</sup> ±3.73	25.92 <sup>f,p</sup> ±5.86	32.60 <sup>r</sup> ±4.89	26.31 <sup>c,r,p</sup> ±5.83	<b>55.35<sup>c,b,e,f,j,p</sup></b> <b>±6.64</b>	27.27 <sup>c,r,p</sup> ±6.71	42.26 <sup>b,f,r,j,p</sup> ±5.02
Science magazines	<b>72.78<sup>f,r,p</sup></b> <b>±3.42</b>	<b>74.07<sup>f,r</sup></b> <b>±5.96</b>	<b>70.65<sup>f,r,p</sup></b> <b>±4.75</b>	<b>52.63<sup>c,b,e,j,p</sup></b> <b>±6.61</b>	<b>51.78<sup>c,b,e,j,p</sup></b> <b>±6.68</b>	<b>79.54<sup>f,r</sup></b> <b>±6.08</b>	<b>87.62<sup>c,b,e,f,r</sup></b> <b>±3.34</b>
NGOs	54.43 ±3.83	53.70 ±6.79	47.82 ±5.21	<b>56.14</b> <b>±6.60</b>	<b>53.57</b> <b>±6.67</b>	43.18 ±7.47	47.42 ±5.07
Family	47.92 ±3.84	27.77 ±6.10	31.52 ±4.84	26.31 ±5.83	41.07 ±6.57	27.27 ±6.71	34.02 ±4.81

<sup>14</sup> The top three trusted information sources of each stakeholder are in bold.

## I. *Quality of information*

High information seekers such as journalists, businessmen, extension workers, and policy makers rate the information they have received so far on biotechnology as very somewhat useful ( $\bar{x}$ =4.72). Policy makers have rated highly ( $\bar{x}$ =5.27  $\pm$  0.175) the usefulness of the information they get from various sources on biotechnology (Table 20). About 68 percent ( $\pm$  4.74) find the information to be very useful and only 6.20% ( $\pm$  2.45) think otherwise. Journalists are also confident about the information they have on biotechnology ( $\bar{x}$ =5.14  $\pm$  0.301). Nearly 70 percent ( $\pm$  6.88) as very useful and moderately useful. This assessment, however, is not related to the importance they attach to biotechnology as a news story ( $p > 0.05$ ).

TABLE 20: PERCEIVED USEFULNESS OF INFORMATION  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)

Stakeholder (n=606)	Mean score ( $\pm$ s.e., max 7)	Not useful (1-3)	Somewhat useful (4)	Very useful (5-7)
Consumers (169)	4.60 $\pm$ 0.108	8.80 $\pm$ 2.18	35.50 $\pm$ 3.68	34.32 $\pm$ 3.65
Businessmen (54)	5.07 $\pm$ 0.248	7.40 $\pm$ 3.56	24.10 $\pm$ 5.82	53.70 $\pm$ 6.79
Extension Workers (92)	4.96 $\pm$ 0.168	8.70 $\pm$ 2.94	23.90 $\pm$ 4.45	64.13 $\pm$ 5.00
Farmer Leaders (57)	4.28 $\pm$ 0.274	19.30 $\pm$ 5.23	22.80 $\pm$ 5.56	47.36 $\pm$ 6.61
Religious Leaders (56)	4.09 $\pm$ 0.238	12.50 $\pm$ 4.42	44.60 $\pm$ 6.64	33.92 $\pm$ 6.33
Journalists (44)	5.14 $\pm$ 0.301	-0-	20.50 $\pm$ 6.09	70.45 $\pm$ 6.88
Policy Makers (97)	5.27 $\pm$ 0.175	6.20 $\pm$ 2.45	22.70 $\pm$ 4.25	68.04 $\pm$ 4.74
Scientists (37)	4.38 $\pm$ 0.386	2.70 $\pm$ 2.67	13.50 $\pm$ 5.62	64.86 $\pm$ 7.85

Even among stakeholders who claim to be not frequent users or seekers of biotechnology information find the information they have seen so far as rather useful. Consumers rate the information they have about biotechnology as somewhat useful ( $\bar{x}$ =4.60  $\pm$  .108). A little over one-third ( $\pm$  3.68) of the consumers surveyed say that they find the information somewhat useful while 34.32% ( $\pm$  3.65) find the information to be very useful.

Religious leaders and farmer leaders tend to rate low the usefulness of biotechnology information compared to other stakeholders. There are more farmer leaders (19.30%,  $\pm$  5.23) and religious leaders (12.50%,  $\pm$  4.42) who do not consider the information they get on biotechnology

as useful or relevant. Among scientists, only 64.86% ( $\pm 7.85$ ) consider the information to be very useful.

*TABLE 21: IS THE INFORMATION SCIENTIFIC?  
(MEAN SCORES AND PERCENTAGE DISTRIBUTION)*

<i>Stakeholder (n=606)</i>	<i>Mean score (<math>\pm</math> s.e., max 7)</i>	<i>Not at all scientific</i>	<i>Somewhat scientific</i>	<i>Very scientific</i>
Consumers (169)	4.48 $\pm$ 0.104	17.70 $\pm$ 2.94	26.60 $\pm$ 3.40	53.25 $\pm$ 3.84
Businessmen (54)	4.61 $\pm$ 0.212	11.10 $\pm$ 4.28	29.60 $\pm$ 6.21	55.55 $\pm$ 6.76
Extension Workers (92)	4.84 $\pm$ 0.149	8.70 $\pm$ 2.94	28.30 $\pm$ 4.70	60.86 $\pm$ 5.09
Farmer Leaders (57)	4.32 $\pm$ 0.242	14.00 $\pm$ 4.60	31.60 $\pm$ 6.16	45.61 $\pm$ 6.60
Religious Leaders (56)	4.02 $\pm$ 0.220	17.80 $\pm$ 5.11	46.40 $\pm$ 6.66	30.35 $\pm$ 6.14
Journalists (44)	4.59 $\pm$ 0.273	2.30 $\pm$ 2.26	29.50 $\pm$ 6.88	59.09 $\pm$ 7.41
Policy Makers (97)	4.90 $\pm$ 0.149	9.20 $\pm$ 2.94	28.90 $\pm$ 4.60	59.79 $\pm$ 4.98
Scientists (37)	4.03 $\pm$ 0.371	8.10 $\pm$ 4.49	24.30 $\pm$ 7.05	48.64 $\pm$ 8.22

Philippine stakeholders have found the information they have received on biotechnology as somewhat scientific ( $\bar{x}$  = 4.47). Ironically, except for Philippine scientists ( $\bar{x}$  = 4.03  $\pm$  0.371) and religious leaders ( $\bar{x}$  = 4.02  $\pm$  0.220), all other stakeholders believe that the information they have heard or known about biotechnology tends to be either moderately or highly scientific. Policy makers and extension workers give it a relatively higher rating at 4.90 ( $\pm$  0.149) and 4.84 ( $\pm$  0.149) respectively. More or less 50% of consumers, businessmen, extension workers, policy makers, and journalists consider the information highly scientific. In particular, 60.86 percent ( $\pm$  5.09) of extension workers and 59.79% ( $\pm$  4.98) of policy makers think that it is highly scientific. Nearly one-third of all stakeholders have rated it as being somewhat scientific.

Except for consumers, the use of, or exposure to special media such as websites, books, pamphlets, and special interpersonal sources are significantly associated with assessments of information as useful. Among businessmen, religious leaders, scientists, and policy makers, their use of or exposure to special media is significantly related to their estimate of information as scientific (Table 22).

TABLE 22: CORRELATION BETWEEN INFORMATION AS SCIENTIFIC AND KEY VARIABLES  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)

Stakeholder (n=606)	Scientific & Interest	Scientific & Concern	Scientific & Perceived risks	Scientific & Perceived benefits	Scientific info & Factual knowledge	Scientific info & Attitudes
Consumers	0.27140 <sup>a</sup>	0.29072 <sup>a</sup>	0.08334	0.18926 <sup>c</sup>	<b>0.36922<sup>a</sup></b>	<b>0.46170<sup>a</sup></b>
Businessmen	<b>0.36909<sup>b</sup></b>	<b>0.30784<sup>c</sup></b>	-0.22049	<b>0.49504<sup>a</sup></b>	0.24830	0.33307
Extension Workers	0.20821 <sup>c</sup>	0.13910	-0.23494 <sup>c</sup>	<b>0.38848<sup>a</sup></b>	-0.00212	0.25307 <sup>c</sup>
Farmer Leaders	0.08022	<b>0.38630<sup>b</sup></b>	0.13452	<b>0.34865<sup>b</sup></b>	0.23624	0.01960
Religious Leaders	<b>0.49381<sup>a</sup></b>	<b>0.44599<sup>a</sup></b>	0.11107	<b>0.46351<sup>a</sup></b>	<b>0.47229<sup>a</sup></b>	<b>0.47229<sup>b</sup></b>
Journalists	<b>0.30475<sup>c</sup></b>	-0.09623	<b>0.45311<sup>b</sup></b>	0.13695	0.22579	<b>0.30387<sup>c</sup></b>
Policy Makers	0.27299 <sup>b</sup>	0.09154	-0.11885	0.24070 <sup>c</sup>	<b>0.30405<sup>b</sup></b>	0.22104 <sup>c</sup>
Scientists	<b>0.62160<sup>a</sup></b>	<b>0.57282<sup>a</sup></b>	0.27890	<b>0.69437<sup>a</sup></b>	<i>Not asked</i>	<i>Not asked</i>

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

TABLE 23: CORRELATION BETWEEN SPECIAL MEDIA CONTACTS (SMC) AND SPECIAL INTERPERSONAL CONTACTS (SIC) AND QUALITY OF INFORMATION  
(Spearman Correlation Coefficients / Prob > |R| under Ho: Rho=0)

Stakeholder (n=606)	SMC & Info as useful	SMC & Info as scientific	SIC & Info as useful	SIC & Info as scientific
Consumers	0.22619 <sup>b</sup>	0.13749	0.22548 <sup>b</sup>	0.21221 <sup>b</sup>
Businessmen	<b>0.62703<sup>a</sup></b>	<b>0.40100<sup>b</sup></b>	<b>0.60483<sup>a</sup></b>	<b>0.36934<sup>b</sup></b>
Extension Workers	<b>0.37961<sup>a</sup></b>	0.26348 <sup>b</sup>	<b>0.37936<sup>a</sup></b>	0.28554 <sup>b</sup>
Farmer Leaders	<b>0.42490<sup>a</sup></b>	0.29030 <sup>c</sup>	<b>0.43722<sup>a</sup></b>	0.22272
Religious Leaders	<b>0.32323<sup>b</sup></b>	<b>0.35083<sup>b</sup></b>	<b>0.33756<sup>b</sup></b>	<b>0.50525<sup>a</sup></b>
Journalists	<b>0.35761<sup>c</sup></b>	0.23694	<b>0.40323<sup>b</sup></b>	<b>0.35186<sup>c</sup></b>
Policy Makers	<b>0.52071<sup>a</sup></b>	<b>0.32588<sup>a</sup></b>	<b>0.54126<sup>a</sup></b>	0.27459 <sup>b</sup>
Scientists	<b>0.47099<sup>b</sup></b>	<b>0.39053<sup>b</sup></b>	<b>0.56097<sup>a</sup></b>	<b>0.49999<sup>a</sup></b>

<sup>a</sup> Significant at .001 level; <sup>b</sup> Significant at .01 level; <sup>c</sup> Significant at .05 level

As indicated by the correlations in Table 23, whenever the biotechnology information received is thought of as scientific, it is also accompanied by increased interest in the topic as in the case of businessmen, religious leaders, journalists, and scientists. It is strongly associated with concerns expressed by businessmen, farmer leaders, religious leaders, and scientists. Strong correlations between stakeholders' assessment of information as scientific and perceived benefits can be noted in businessmen, extension workers, farmer leaders, religious leaders, and scientists. It does not seem to have a bearing on perceptions of risks except among journalists.

Formatting biotechnology information in a scientific way can also bolster factual knowledge about and positive attitudes towards biotechnology, especially among consumers and policy makers.

*TABLE 24: OTHER TYPES OF ISSUES/CONCERNS THEY HAVE HEARD OR KNOWN ABOUT BIOTECHNOLOGY<sup>15</sup>*

<i>Stakeholder (n=606)</i>	<i>Political</i>	<i>Religious</i>	<i>Moral/Ethics</i>	<i>Cultural</i>
Consumers (169)	53.84	50.88	62.72	55.62
Businessmen (54)	48.14	35.18	55.55	40.74
Extension Workers (92)	40.21	33.69	52.17	46.73
Farmer Leaders (57)	35.08	31.57	49.12	45.61
Religious Leaders (56)	16.07	37.50	62.50	28.57
Journalists (44)	43.18	43.18	56.81	52.27
Policy Makers (97)	48.45	43.29	70.10	45.36
Scientists (37)	35.13	32.43	29.72	24.32

When asked about other types of issues or concerns they may have heard or known about biotechnology, issues related to the morality and ethics of biotechnology tend to prevail over political, religious, and cultural concerns (Table 24). Morality and ethical issues on biotech have been cited most by policy makers (70.10%), consumers (62.72%), and religious leaders (62.50%). These issues, on the other hand, have been mentioned the least by scientists (29.72%).

The same issues rank high among all stakeholders when asked about concerns that would influence their judgment about biotechnology (Table 25). Nearly 83% of religious leaders, 62.88% of policy makers, and 57.40% of businessmen have pointed out issues of morality and ethics as swaying their judgments on biotechnology. Stakeholders have cited religious concerns or issues as having least influence on their judgments about biotechnology.

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<sup>15</sup> Question requires multiple responses, thus percentages do not add up to 100. Percentages represent number of respondents citing an issue or concern, other than scientific ones, that they have heard or known about biotechnology.

TABLE 25: ISSUES THAT WOULD INFLUENCE JUDGMENT<sup>16</sup>

<i>Stakeholder (n=606)</i>	<i>Political</i>	<i>Religious</i>	<i>Moral/Ethics</i>	<i>Cultural</i>
Consumers (169)	29.58	28.40	53.84	35.50
Businessmen (54)	22.22	2.03	57.40	33.33
Extension Workers (92)	13.04	5.50	48.91	53.26
Farmer Leaders (57)	19.29	19.29	50.87	33.33
Religious Leaders (56)	5.35	55.35	83.92	23.21
Journalists (44)	18.18	25.00	47.72	31.81
Policy Makers (97)	13.40	11.34	62.88	25.77
Scientists (37)	5.40	13.51	43.24	21.62

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<sup>16</sup> Question requires multiple responses, thus percentages do not add up to 100. Percentages represent number of respondents citing an issue or factor as being influential to judgments about biotechnology.

**J. Applications of Biotechnology: Making judgments**

**TABLE 26: BIOTECHNOLOGY APPLICATIONS AND ISSUES POLICY MAKERS SAY THEY WOULD FOCUS ON WHEN MAKING DECISIONS ON BIOTECHNOLOGY**

<b>FRAMES FOR POLICY DECISION MAKING</b>	<b>Never</b>	<b>Seldom</b>	<b>Almost always</b>	<b>All the time</b>	<b>Don't Know</b>
1. Make food more nutritious, taste better, and keep longer	6.20 (± 2.44)	15.50 (± 3.67)	56.70 (± 5.03)	18.60 (± 3.95)	3.10 (± 1.76)
2. Make crops resistant to pests & diseases	3.10 (± 1.75)	10.30 (± 3.08)	60.80 (± 4.95)	21.60 (± 4.17)	4.10 (± 2.01)
3. Produce medicines & vaccines	7.20 (± 2.62)	20.60 (± 4.10)	47.40 (± 5.06)	17.50 (± 3.86)	7.20 (± 2.62)
4. Study human diseases like cancer	6.20 (± 2.45)	17.50 (± 2.62)	46.40 (± 5.06)	22.70 (± 4.25)	7.20 (± 2.62)
5. Introduce fish genes into strawberries for resistance to freezing	21.60 (± 4.17)	29.90 (± 4.64)	30.90 (± 4.69)	10.30 (± 3.08)	7.20 (± 2.62)
6. Detect & treat diseases inherited from parents	12.40 (± 3.35)	20.60 (± 4.11)	40.20 (± 4.98)	21.60 (± 4.18)	5.20 (± 2.25)
7. GM foods are safe & tested	2.10 (± 1.46)	13.40 (± 3.46)	46.40 (± 5.06)	33.00 (± 4.77)	5.20 (± 2.25)
8. GM crops will be so resistant to pests and diseases but will push native plants into extinction	7.20 (± 2.62)	30.90 (± 4.69)	27.80 (± 4.55)	15.50 (± 3.67)	18.60 (± 3.95)
9. No evidence GM crops can harm environment	6.20 (± 2.45)	33.00 (± 4.77)	43.30 (± 5.03)	12.40 (± 3.35)	5.20 (± 2.25)
10. GM crops will contaminate native plant species and further reduce biodiversity	7.20 (± 2.62)	42.30 (± 5.02)	32.00 (± 4.74)	11.30 (± 3.21)	7.20 (± 2.62)
11. Farmers want GM crops because they make crop production cheaper, increase yield, and increase income.	3.10 (± 1.76)	16.50 (± 3.77)	53.60 (± 5.06)	20.60 (± 4.11)	6.20 (± 2.45)
12. Opponents of modern biotechnology have no factual evidence for their claims of negative health consequences or environmental impact.	4.10 (± 2.01)	22.70 (± 4.25)	55.70 (± 5.04)	11.30 (± 3.21)	6.20 (± 2.45)
13. For plant breeders and farmers, modern biotechnology is simply another tool to increase productivity.	4.10 (± 2.01)	22.70 (± 4.25)	55.70 (± 5.04)	11.30 (± 3.21)	6.20 (± 2.45)
14. Pest-resistant GM crops would also harm non-target organisms like butterflies.	5.20 (± 2.25)	32.00 (± 4.74)	42.30 (± 5.02)	14.40 (± 3.56)	6.20 (± 2.45)

There is apparent interest among policy makers in the Philippines to focus on specific biotechnology applications and benefits as part of the decision making process (Table 26). At least 80% has expressed intention to consider with some frequency on the use of biotechnology to make crops resistant to pests and diseases. Close to 80% has also said that they will focus on the safety of GM foods and that these have been tested. No less than 70% intend to consider the use of biotechnology to make food more nutritious, taste better, and keep longer, and on the potential benefit of biotechnology to make crop production cheaper, increase yield, and increase income. Nearly 70% say that part of their decision making discourse will deal with biotechnology as another tool to increase productivity and study human diseases like cancer as well as the issue that opponents of modern biotechnology have no factual evidence for their claims of negative health consequences or environmental impact. At least 60% have expressed intention to concentrate on the application of biotechnology to produce medicines and vaccines or to detect and treat diseases inherited from parents. About 56% say that will frequently emphasize there is no evidence GM crops can harm the environment.

On the possible negative effects of biotechnology on the environment, around 43% have reported that they will take into account in decision making such issues as the possibility that GM crops will push native plants into extinction and further reduce biodiversity. Nearly 57% say that they will also bear in mind the potential risk of GM crops on non-target organisms like butterflies.

Not surprisingly, only 41.20% have expressed interest in the application of biotechnology in introducing fish genes into strawberries for resistance to freezing. Apparently, they believe they do not have to deal much with this type of issue in tropical Philippines.

TABLE 27: BIOTECHNOLOGY APPLICATIONS AND ISSUES **JOURNALISTS** SAY THEY WOULD TEND TO FOCUS ON WHEN COVERING OR REPORTING ON BIOTECHNOLOGY

<b>FRAMES FOR MASS MEDIA COVERAGE</b>	<b>Never</b>	<b>Seldom</b>	<b>Almost always</b>	<b>All the time</b>	<b>Don't Know</b>
1. Make food more nutritious, taste better, and keep longer	2.30 (± 2.26)	36.40 (± 7.25)	31.80 (± 7.02)	20.50 (± 6.08)	9.10 (± 4.34)
2. Make crops resistant to pests & diseases	2.30 (± 2.26)	29.50 (± 6.88)	43.20 (± 7.47)	18.20 (± 5.82)	6.80 (± 3.80)
3. Produce medicines & vaccines	9.10 (± 4.34)	34.10 (± 7.15)	31.80 (± 7.02)	15.90 (± 5.51)	9.10 (± 4.34)
4. Study human diseases like cancer	11.40 (± 4.79)	27.30 (± 6.72)	29.50 (± 6.88)	22.70 (± 6.32)	9.10 (± 4.34)
5. Introduce fish genes into strawberries for resistance to freezing	20.50 (± 6.08)	40.90 (± 7.41)	13.60 (± 5.17)	11.40 (± 4.79)	13.60 (± 5.17)
6. Detect & treat diseases inherited from parents	6.80 (± 3.80)	22.70 (± 6.32)	36.40 (± 7.25)	25.00 (± 6.53)	9.10 (± 4.34)
7. GM foods are safe & tested	4.50 (± 3.13)	15.90 (± 5.51)	45.50 (± 7.51)	25.00 (± 6.53)	9.10 (± 4.34)
8. GM crops will be so resistant to pests and diseases but will push native plants into extinction	13.60 (± 5.17)	20.50 (± 6.09)	29.50 (± 6.88)	27.30 (± 6.72)	9.10 (± 4.34)
9. No evidence GM crops can harm environment	11.40 (± 4.79)	36.40 (± 7.25)	27.30 (± 6.72)	13.60 (± 5.17)	11.40 (± 4.79)
10. GM crops will contaminate native plant species and further reduce biodiversity	9.10 (± 4.34)	11.40 (± 4.79)	31.40 (± 7.00)	36.40 (± 7.25)	11.40 (± 4.79)
11. Farmers want GM crops because they make crop production cheaper, increase yield, and increase income.	6.80 (± 3.80)	20.50 (± 6.09)	45.50 (± 7.51)	18.20 (± 5.82)	9.10 (± 4.34)
12. Opponents of modern biotechnology have no factual evidence for their claims of negative health consequences or environmental impact.	11.40 (± 4.79)	34.10 (± 7.14)	27.30 (± 6.72)	15.90 (± 5.51)	11.40 (± 4.79)
13. For plant breeders and farmers, modern biotechnology is simply another tool to increase productivity.	11.40 (± 4.80)	20.50 (± 6.09)	38.60 (± 7.34)	15.90 (± 5.51)	13.60 (± 5.17)
14. Pest-resistant GM crops would also harm non-target organisms like butterflies.	13.60 (± 5.17)	11.40 (± 4.79)	34.10 (± 7.15)	27.30 (± 6.72)	13.60 (± 5.17)

In general, Philippine journalists seem to take a rather ambivalent or cautious approach to covering biotechnology (Table 27). A little over 70% have expressed intention to focus with some frequency the issue that GM foods are safe and tested. They are quite reluctant to say that there is no evidence GM crops can harm the environment or that opponents of biotechnology have no factual evidence for their claims of negative health consequences or environmental impact.

On the other hand, nearly 68% have said that they will often cover the issue of GM crops as contaminating native plant species and further reducing biodiversity. About 60% say that their coverage may focus with some regularity on the possible harm of GM crops on non-target organisms like butterflies, and around 57% have said that they will frequently report about the possibility that GM crops will push native plants into extinction.

There is clear interest to cover the medical applications of biotechnology such as detecting and treating diseases inherited from parents, studying human diseases like cancer, and producing medicines and vaccines. Likewise, at least 50% have said that they will highlight the use of biotechnology to a) make food more nutritious, taste better, and keep longer, b) increase farm productivity, c) make crops resistant to pests and diseases.

They will focus least on the use of biotechnology to introduce fish genes into strawberries for resistance to freezing.

TABLE 28: BIOTECHNOLOGY APPLICATIONS AND ISSUES **SCIENTISTS** SAY THEY WOULD TEND TO FOCUS ON WHEN TALKING ABOUT BIOTECHNOLOGY

<b>FRAMES FOR SCIENTISTS' DISCUSSIONS</b>	<b>Never</b>	<b>Seldom</b>	<b>Almost always</b>	<b>All the time</b>	<b>Don't Know</b>
1. Make food more nutritious, taste better, and keep longer	8.10 (± 4.49)	18.90 (± 6.44)	32.40 (± 7.69)	16.20 (± 6.06)	24.30 (± 7.05)
2. Make crops resistant to pests & diseases	2.70 (± 2.66)	8.10 (± 4.49)	37.80 (± 7.97)	29.70 (± 7.51)	21.60 (± 6.77)
3. Produce medicines & vaccines	16.20 (± 6.06)	24.30 (± 7.05)	32.40 (± 7.69)	8.10 (± 4.49)	18.90 (± 6.44)
4. Study human diseases like cancer	5.40 (± 3.72)	21.60 (± 6.77)	37.80 (± 7.97)	8.10 (± 4.49)	27.00 (± 7.30)
5. Introduce fish genes into strawberries for resistance to freezing	27.00 (± 7.30)	24.30 (± 7.05)	21.60 (± 6.77)	2.70 (± 2.66)	24.30 (± 7.05)
6. Detect & treat diseases inherited from parents	8.10 (± 4.49)	29.70 (± 7.51)	29.70 (± 7.51)	10.80 (± 5.10)	21.60 (± 6.77)
7. GM foods are safe & tested	10.80 (± 5.10)	24.30 (± 7.05)	29.70 (± 7.51)	16.20 (± 6.06)	18.90 (± 6.44)
8. GM crops will be so resistant to pests and diseases but will push native plants into extinction	2.70 (± 2.66)	5.40 (± 3.72)	18.90 (± 6.44)	21.60 (± 6.77)	51.40 (± 8.22)
9. No evidence GM crops can harm environment	16.20 (± 6.06)	24.30 (± 7.05)	32.40 (± 7.69)	2.70 (± 2.66)	24.30 (± 7.05)
10. GM crops will contaminate native plant species and further reduce biodiversity	5.40 (± 3.72)	18.90 (± 6.44)	32.40 (± 7.69)	13.50 (± 5.62)	29.70 (± 7.51)
11. Farmers want GM crops because they make crop production cheaper, increase yield, and increase income.	8.10 (± 4.49)	27.00 (± 7.30)	37.80 (± 7.97)	2.70 (± 2.66)	24.30 (± 7.05)
12. Opponents of modern biotechnology have no factual evidence for their claims of negative health consequences or environmental impact.	18.90 (± 6.44)	21.60 (± 6.77)	35.10 (± 7.85)	2.70 (± 2.66)	21.60 (± 6.77)
13. For plant breeders and farmers, modern biotechnology is simply another tool to increase productivity.	2.70 (± 2.66)	10.80 (± 5.10)	54.10 (± 8.19)	10.80 (± 5.10)	21.60 (± 6.77)
14. Pest-resistant GM crops would also harm non-target organisms like butterflies.	5.40 (± 3.72)	16.20 (± 6.06)	32.40 (± 7.69)	24.30 (± 7.05)	21.60 (± 6.77)

In looking at the possible pattern of discourse that Philippine scientists may have on biotechnology, it is remarkable to note the large numbers of “Don’t know” answers. In particular, on the issue that GM crops will push native plants into extinction, although 40.50% say that will almost always focus on this topic when talking about biotechnology, a considerable 51.40% have also answered “Don’t know.” Nearly 30% have also taken a similar position when asked about the issue that GM crops will contaminate native plant species and further reduce biodiversity.

However, at least 65% of Philippine scientists appear to be quite comfortable in talking about the uses of biotechnology to make crops resistant to pests and diseases, and increase farm productivity. About 57% say that they will always talk about the possible harm that GM crops may have on non-target organisms like butterflies, and nearly 46% intend to talk about the effects of GM crops on biodiversity.

Less than 50% of those surveyed have expressed interest to talk about the other uses or applications of biotechnology. There is not as much observable enthusiasm among scientists in dealing with the medical applications of biotechnology. For example, 40.50% say that they will usually talk about the biotechnology’s application in producing medicines and vaccines, while another 40.50% say that they will hardly talk about it. Similarly, in the use of biotechnology to detect and treat diseases inherited from parents, 40.50% of the scientists say that it is a topic they will frequently talk about, but nearly 38.00% are lukewarm to the idea.

Even when it comes to the argument that GM foods are safe and tested, Philippine scientists seem to have mixed feelings in dealing with the idea. Nearly 46.00 percent say that they will usually use it as a focus for discussion, while 35.10% say that they either will seldom or not talk about it at all.

On the other hand, they appear to be strongly against saying talking about the issue that opponents of modern biotechnology have no factual evidence for their claims of negative health consequences or environmental impact. Similarly, they will not talk about the issue that there is no evidence GM crops can harm the environment.

Only 24.30% will focus on introducing fish genes into strawberries for resistance to freezing.

TABLE 29: BIOTECHNOLOGY APPLICATIONS **OTHER STAKEHOLDERS** SAY THEY WOULD CONSIDER WHEN MAKING JUDGMENTS ON BIOTECHNOLOGY<sup>17</sup>

a. *Use of modern biotechnology in the production of foods to make them more nutritious, taste better, and keep longer.*

<i>Stakeholder</i>	<i>Useful</i>	<i>Risky</i>	<i>Morally acceptable</i>	<i>To be encouraged</i>	<i>Not sure</i>
<b>Consumers</b>	62.72	24.26	21.30	24.85	1.80
<b>Businessmen</b>	30.70	14.80	48.10	25.90	7.40
<b>Extension Workers</b>	40.21	19.56	25.00	28.26	6.50
<b>Farmer Leaders</b>	26.31	31.57	36.84	29.82	8.80
<b>Religious Leaders</b>	35.71	58.92	16.07	14.28	3.60

Among the five Philippine stakeholders, consumers (62.72%) tend to approve most of using biotechnology to make food more nutritious, taste better, and keep longer. Perceived usefulness of this biotechnology application from businessmen, farmer leaders, and religious leaders are in the low to middle 30 percent. Nearly 60% of religious leaders, however, say that this application of biotechnology is rather risky, 16% believe that it is morally acceptable and only 14.28% think that it should be encouraged. Overall, less than 50% of the other stakeholders including religious leaders say that this particular application of biotechnology is useful. Although, only 14.80% of the businessmen and 20% of extension workers think that it is risky, this application cannot muster enough support from one-third of the consumers, businessmen, extension workers, and farmer leaders to encourage the use of biotechnology for the purpose of making food more nutritious, taste better, and keep longer.

b. *Taking genes from plant species and transferring them into crop plants, to make them more resistant to pests and diseases.*

<i>Stakeholder</i>	<i>Useful</i>	<i>Risky</i>	<i>Morally acceptable</i>	<i>To be encouraged</i>	<i>Not sure</i>
<b>Consumers</b>	59.76	29.58	19.52	20.71	1.20
<b>Businessmen</b>	30.70	7.40	25.90	22.20	7.40
<b>Extension Workers</b>	48.91	20.65	18.47	31.52	4.30
<b>Farmer Leaders</b>	45.61	14.03	22.80	40.35	7.00
<b>Religious Leaders</b>	48.21	44.64	17.85	17.85	3.60

Most Philippine stakeholders, including religious leaders, are in agreement with this feature of biotechnology. In particular, nearly 60% of the consumers and half of the extension workers, religious leaders, and farmer leaders surveyed believe that it is a useful application of

<sup>17</sup> The tables report multiple responses; hence, the percentages should not add up to 100 across stakeholders or across responses.

biotechnology. Remarkably, only 30.70% of the Philippine businessmen find this useful, although very few of them (7.40%) view this application as risky.

Overall, the moral acceptability of this biotechnology application does not go beyond 25%. Although 40% of farmer leaders believe that this use of biotechnology should be encouraged, support from the other four stakeholders ranges from a low of 17% to a high of 31%.

*c. Introducing human genes into bacteria to produce medicines or vaccines, for example, to produce insulin for diabetes.*

<i>Stakeholder</i>	<i>Useful</i>	<i>Risky</i>	<i>Morally acceptable</i>	<i>To be encouraged</i>	<i>Not sure</i>
<b>Consumers</b>	60.94	33.13	19.52	19.52	1.80
<b>Businessmen</b>	70.40	18.50	51.90	22.20	-
<b>Extension Workers</b>	45.65	19.56	17.39	34.78	4.30
<b>Farmer Leaders</b>	35.08	31.57	21.05	31.57	8.80
<b>Religious Leaders</b>	41.07	58.92	10.71	10.71	5.40

Nearly 70% of Philippine businessmen and 60% of consumers feel that this medical application of biotechnology is useful. Less than 50% of extension workers, religious leaders, and farmer leaders share this view of businessmen and consumers. Nearly 60% of religious leaders believe that this particular application of biotechnology is rather risky, and close to one-third of the consumers and farmer leaders also think about the possible risks. Not surprisingly, only 10.71% of religious leaders find it morally acceptable and the same number say that it should be encouraged.

Less than 20% of the businessmen and extension workers think that the use of biotechnology to produce medicines or vaccines is risky. In particular, 51.90% of the businessmen think that it is morally acceptable. Clearly, there is not a lot of support from consumers and businessmen about encouraging the use of biotechnology for this purpose. Nonetheless, even among extension workers and farmer leaders, belief that this particular biotechnology application is in the low to mid-30%.

*d. Modifying genes of laboratory animals such as a mouse to study human diseases like cancer.*

<i>Stakeholder</i>	<i>Useful</i>	<i>Risky</i>	<i>Morally acceptable</i>	<i>To be encouraged</i>	<i>Not sure</i>
<b>Consumers</b>	66.27	28.99	13.60	39.00	1.20
<b>Businessmen</b>	22.20	14.80	44.40	18.50	-
<b>Extension Workers</b>	50.00	16.30	11.95	33.69	6.50
<b>Farmer Leaders</b>	43.85	22.80	22.80	28.07	10.50
<b>Religious Leaders</b>	57.14	37.50	16.07	8.92	3.60

Consumers (66.27%) lead the other stakeholders in appreciating the usefulness of modifying genes of laboratory animals such as a mouse to study human diseases like cancer, followed by religious leaders (57.14%) and extension workers (50%). In spite of such positive views, however, only 8.92% of religious leaders say that this application should be encouraged. More or less one-third of the religious leaders surveyed also believe that this application is risky, and less than 20% think that it is morally acceptable.

On the other hand, while businessmen do not think much about the usefulness of this application, 44% of those surveyed have no quarrel about its moral acceptability. Overall, the assessment of risks relating to this application seems rather low, but there is not much expressions of encouragement either for pursuing this particular application.

e) *Using genetic testing to detect and treat diseases we might have inherited from our parents.*

<i>Stakeholder</i>	<i>Useful</i>	<i>Risky</i>	<i>Morally acceptable</i>	<i>To be encouraged</i>	<i>Not sure</i>
<b>Consumers</b>	58.57	22.48	21.30	26.03	3.60
<b>Businessmen</b>	30.70	7.40	44.40	25.90	18.50
<b>Extension Workers</b>	52.17	14.13	14.13	27.17	9.80
<b>Farmer Leaders</b>	49.12	12.28	19.29	29.82	15.80
<b>Religious Leaders</b>	53.57	39.28	21.42	8.92	3.60

Evidently, with the exception of businessmen, most of the stakeholders surveyed think that the use of genetic testing to detect and treat diseases we might have inherited from parents is not an issue. Nearly 60% of the consumers are quite positive about this particular biotechnology application, while 50% of extension workers, religious leaders, and farmer leaders share the similar views with consumers. Nonetheless, the ambivalence remains evident. There continues to be very low numbers reported when it comes to affirming the moral acceptability of this application and no more than 30% have said that it should be encouraged. In particular, only 8.92% of the religious leaders believe that this application must be encouraged.

Overall, there is a unanimous sense of ambivalence among consumers, businessmen, extension workers, religious leaders, and farmer leaders about the specific applications of biotechnology on food, agriculture, and medicine. While there is some appreciation for the potential benefits, there appears to be unanswered concerns being felt about moral questions and possible risks, hence the low numbers reported on the respondents saying that these applications should be encouraged. On the other hand, the consistent opposition of Philippine religious leaders

in terms of the moral acceptability of biotechnology is to be expected. What is most interesting is to note that for the most part Philippine consumers, businessmen, farmer leaders, and extension workers are undecided about biotechnology issues.

#### IV. SURVEY HIGHLIGHTS

##### A. The Philippine Consumers<sup>18</sup>

- Demographics: 49.7% male and 49.1% female; 50.3% are single and 43.2% are married. 79.3% have college degrees and 6.5% have only a high school education. 71.6% live in an urban area, 14.8% suburban, and 11.2% rural.
- Moderately interested in biotechnology
- Moderately concerned about biotechnology issues
- Perceive the risks of biotechnology to be moderate
- Perceive the benefits of biotechnology to be between moderate to high
- Have a high regard for a) research institutes (89.30%), b) agri-biotech companies (72.18%), and university scientists (75.20%) as being highly concerned about public health and safety issues relating to biotechnology
- Believe that a) regulatory bodies (92.9%), b) research institutes (90.53%), and c) agri-biotech companies (87.57%) have total responsibility for conducting risk assessment and risk management on biotechnology
- Have a very high regard for the role of science in the development of agriculture in the Philippines (81.1%)
- Rate themselves as having a moderate understanding of science
- Rate themselves as having a moderate understanding of biotechnology
- Generally have moderate scores on factual knowledge of biotechnology
- Generally, exhibit moderate attitudes toward biotechnology.
- *On banning GM foods*: 47% are in favor of being actively involved in banning GM foods. 41.4% are not in favor.
- *On labeling GM foods*: 95.3% believe that GM foods should be labeled.
- *On benefits of biotechnology to small farmers*: 69.8% believe that agricultural biotechnology will benefit small farmers
- *On the benefits of biotechnology to Philippine agriculture*: 59.2% believe that biotechnology is good for Philippine agriculture. 32%, on the other hand, do not think that biotechnology will bring benefits to Philippine agriculture.
- *On the adequacy of biotechnology regulations in the Philippines*: 49.1% think that current biotechnology regulations in the Philippines are sufficient. 42.1% do not think that there are sufficient regulations.
- *On paying extra costs for the labeling of GM foods*: 48% indicate that they will pay extra for the labeling of GM foods, whereas 43.8% are not willing to pay extra.

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<sup>18</sup> For complete demographical comparisons across stakeholders, see Appendix 1.

- Tend to receive information about biotechnology from a) general mass media (i.e., radio, television, and newspapers, b) family, friends, or colleagues, and c) scientists/experts. However, only 20% of Philippine consumers have attended to or used biotechnology information from these sources at least three times within a two-month period. The average frequency of contact consumers have had with these media within a two-month period is extremely low.
- Are highly trusting of information that comes from university scientists, science magazines, and websites.
- 34.23% feel that information they have received concerning biotechnology is useful. 35.5% feel that it is only somewhat useful and 9% feel that it is not useful.
- 53.25% feel that the information they receive on biotechnology is highly scientific.
- Think that moral or ethical concerns about biotechnology will influence most their judgment about biotechnology.

## **B. The Philippine Businessmen**

- Moderately interested in biotechnology
- Have above moderate concerns about biotechnology issues
- Perceive the risks of biotechnology to be moderate
- Perceive the benefits of biotechnology to be between moderate to high
- Have a high regard for a) consumer advocacy groups/NGOs (79.70%), b) research institutes (75.90%) and c) university scientists (74%) as being highly concerned about public health and safety issues relating to biotechnology
- Nearly 90% of businessmen surveyed believe that a) regulatory bodies, b) research institutes, and c) agri-biotech companies have total responsibility for conducting risk assessment and risk management on biotechnology.
- Have a very high regard for the role of science in the development of agriculture in the Philippines (89%)
- Rate themselves as having a moderate understanding of science
- Rate themselves as having a moderate understanding of biotechnology
- Generally have a moderate score on factual knowledge about biotechnology
- Generally exhibit moderate attitudes toward biotechnology
- *On banning GM foods:* 67% are not in favor of being actively involved through either time or money in banning GM foods.
- *On labeling GM foods:* 74.4% believe that GM foods should be labeled.
- *On benefits of biotechnology to small farmers:* 59.2% believe that agricultural biotechnology will benefit small farmers.
- *On the benefits of biotechnology to Philippine agriculture:* 78% believe that biotechnology is good for Philippine agriculture.
- *On the adequacy of biotechnology regulations in the Philippines:* 55.5% think that current biotechnology regulations in the Philippines are sufficient.

- *On paying extra costs for the labeling of GM foods:* 51.8% say that they will pay extra for the labeling of GM foods; 33.3% are not willing to pay extra.
- 40.8% claim that they have talked to or consulted with experts or scientists about biotechnology at least thrice within a two-month period. 30% say that they have also used or attended to biotechnology information via radio, television, and newspapers, and 28% have mentioned using special media such as brochures, pamphlets, and newsletters to get information about biotechnology.
- Have sought information from these sources at least 7.29 times
- Are highly trusting of information that comes from university scientists, science magazines and websites
- 53.7% say that information they have received concerning biotechnology is useful.
- 55.55% say that the information they have received is highly scientific.
- Think that moral or ethical concerns about biotechnology will influence most their judgment about biotechnology

### C. The Philippine Extension Workers

- Demographics: 40.2% male and 56.5% female. 15.2% are single and 78.3% are married. All have college degrees: 64.1% have bachelor degrees, 31.5% have graduate/post graduate degrees. 23.9% live in an urban area, 25% percent suburban, and 47% rural.
- Moderately interested in biotechnology
- Moderately concerned about biotechnology issues
- Perceive the risks of biotechnology to be moderate
- Perceive the benefits of biotechnology to be between moderate to high
- Have a high regard for a) research institutes (83.69%), b) consumer advocacy groups/NGOs and c) mass media (66.30%) as being highly concerned about public health and safety issues relating to biotechnology
- Believe that a) regulatory bodies (90.2%), b) research institutes (91.3%), university scientists (88%) and c) agri-biotech companies (87%) have total responsibility for conducting risk assessment and risk management on biotechnology
- Have a very high regard for the role of science in the development of agriculture in the Philippines (96.73%)
- Rate themselves as having a moderate understanding of science
- Rate themselves as having a moderate understanding of biotechnology
- Generally have moderate mean score on factual knowledge of biotechnology
- Generally exhibit moderate attitudes toward biotechnology
- *On banning GM foods:* 66.3% are not in favor of being actively involved through either time or money in banning GM foods.
- *On labeling GM foods:* 95.6% believe that GM foods should be labeled.
- *On benefits of biotechnology to small farmers,* 77.2% believe that agricultural biotechnology will benefit small farmers.

- *On the benefits of biotechnology to Philippine agriculture:* 70.7% believe that biotechnology is good for Philippine agriculture.
- *On the adequacy of biotechnology regulations in the Philippines:* 45.6% believe that current biotechnology regulations in the Philippines are sufficient. 34.7% disagree.
- *On paying extra costs for the labeling of GM foods:* 47% say that they will pay extra for the labeling of GM foods, whereas 34.6% are not willing to pay extra.
- Tend to receive information on biotechnology through radio, television, and newspapers, experts, and pamphlets
- Are highly trusting of information that comes from university scientists, science magazines, websites and private scientists
- 64.13% think that information they have received concerning biotechnology is useful

#### **D. The Philippine Farmer Leaders**

- Demographics: 60% male and 37% female. 17.5% are single and 77.2% are married. 52.6% have college degrees, 22.8% have post graduate degrees, and 17.5% have only a high school education. 19.3% live in an urban area, 17.5% suburban, and 52.60% rural.
- Moderately interested in biotechnology
- Have above moderate concerns about biotechnology
- Perceive the risks of biotechnology to be moderate
- Perceive the benefits of biotechnology to be moderate
- Have a high regard for a) research institutes (72%), b) agri-biotech companies (61.4%) and c) private sector scientists (61.4%) as being highly concerned about public health and safety issues relating to biotechnology
- Believe that a) research institutes (89.5%) b) agri-biotech companies (89.30%) and c) regulatory bodies (87.7%) have total responsibility for conducting risk assessment and risk management on biotechnology.
- Have a very high regard for the role of science in the development of agriculture in the Philippines (97%)
- Rate themselves as having a moderate understanding of science
- Rate themselves as having a moderate understanding of biotechnology
- Generally, have moderate score on factual knowledge about biotechnology.
- Generally exhibit moderate attitudes toward biotechnology
- *On banning GM foods:* 52.6% are not in favor of being actively involved through either time or money in banning GM foods.
- *On labeling GM foods:* 86% think that GM foods should be labeled.
- *On benefits of biotechnology to small farmers:* 56.2% believe that agricultural biotechnology will benefit small farmers
- *On the benefits of biotechnology to Philippine agriculture:* 63.1% believe that biotechnology is good for Philippine agriculture.

- *On the adequacy of biotechnology regulations in the Philippines:* 31.6% believe that current biotechnology regulations in the Philippines are sufficient. 40.3% think that they are not adequate.
- *On paying extra for the labeling of GM foods:* 50.9% say that they will pay extra for the labeling of GM foods, where as 38.6% are not willing to do so.
- Have received information through the general media (22.8%), i.e., radio, television, and newspapers, experts (10.5%) and family/friends (17.50%).
- Have sought information from special interpersonal contacts at least 7.29 times in a two-month period.
- Are highly trusting of information that comes from university scientists, NGOs, science magazines and websites
- 47.36% say that the information they have received concerning biotechnology is useful.
- 45.61% say that the information they have received is highly scientific.
- Believe that moral issues influence will tend to influence their judgments about biotechnology

#### **E. The Philippine Religious Leaders**

- Moderately interested in biotechnology
- Moderately concerned about biotechnology issues
- Perceive the risks of biotechnology to be moderate
- Perceive the benefits of biotechnology to be between moderate to high
- Have a high regard for a) religious groups (67.8%), b) research institutes (62.50%) and c) consumer advocacy groups/NGOs (53.50%) as being highly concerned about public health and safety issues relating to biotechnology
- Believe that a) regulatory bodies (82.1%), b) research institutes (77%), and c) agri-biotech companies (70%) have total responsibility for conducting risk assessment and risk management on biotechnology.
- Have a very high regard for the role of science in the development of agriculture in the Philippines (73.2%)
- Rate themselves as having a moderate understanding of science.
- Rate themselves as having a moderate understanding of biotechnology.
- Generally, have moderate mean score on factual knowledge about biotechnology.
- Generally, exhibit moderate attitudes toward biotechnology.
- *On banning GM foods:* 47% are in favor of being actively involved in banning GM foods.
- *On labeling GM foods:* 94.6% believe that GM foods should be labeled.
- *On benefits of biotechnology to small farmers:* 44.6% believe that agricultural biotechnology will benefit small farmers.
- *On the benefits of biotechnology to Philippine agriculture:* 51.8% believe that biotechnology is good for Philippine agriculture.
- *On the adequacy of biotechnology regulations in the Philippines:* Have ambivalent reactions. 37.5% say that current biotechnology regulations in the

Philippines are sufficient. Another 37.5% say that current regulations are not sufficient.

- *On paying extra for the labeling of GM foods:* 66.1% indicate that they are willing to pay extra for the labeling of GM foods; 19.7% say that they are not willing to do the same.
- Barely 20% of religious leaders have used or received information from the general mass media. Only 8.9% say that they have talked to an expert or a professional about biotechnology and another 8.9% claim to have talked to their colleagues or peers about the topic.
- Are low information seekers when it comes to biotechnology.
- Are highly trusting of information that comes from religious groups, NGOs, science magazines, and university scientists.
- 33.92% think that information they have received concerning biotechnology is useful. 44.60% feel that it is only somewhat useful and 12.50% feel that it is not useful.
- 46.4% feel that the information is moderately scientific. 30.35% feel that the received information is highly scientific, and 18% thought the information was not at all scientific.
- Claim that moral or ethical issues on biotechnology will influence their judgments (83.92%).

## **F. The Philippine Journalists**

- Demographics: 40.9% male, 52.3% female. 31.8% are single and 52.3% are married. 38.6% have college degrees. 52.3% have an associate's degree. 45.5% live in urban areas, 15.9% suburban, and 27.3% rural.
- Moderately to highly interested in biotechnology
- Less than moderately concerned about biotechnology issues
- Perceive the risks of biotechnology to high
- Perceive the benefits of biotechnology to be high
- Have a high regard for a) research institutes (88.63%), b) university scientists (88.60%) and c) farm leaders (75.00%) as being highly concerned about public health and safety issues relating to biotechnology
- Believe that a) research institutes (84.09%), b) regulatory bodies (81.81%), and c) agri-biotech companies (81.81%) have total responsibility for conducting risk assessment and risk management on biotechnology.
- Have a very high regard for the role of science in the development of agriculture in the Philippines (93.18%)
- Rate themselves as having a moderate understanding of science.
- Rate themselves as having a moderate understanding of biotechnology.
- Generally have moderate score on factual knowledge about biotechnology
- Generally, exhibit moderate attitudes toward biotechnology.
- *On banning GM foods:* 52.2% are not in favor of being actively involved in banning GM foods. Only 27.2% would be in favor of this action.

- *On labeling GM foods:* 81.8% think that GM foods should be labeled.
- *On benefits of biotechnology to small farmers:* 68.2% say that agricultural biotechnology will benefit small farmers.
- *On the benefits of biotechnology to Philippine agriculture:* 68.2% believes that biotechnology is good for Philippine agriculture. 18.2%, on the other hand, disagree.
- *On the adequacy of biotechnology regulations in the Philippines:* 45.4% think that current biotechnology regulations in the Philippines are sufficient. 31.8% disagree about the sufficiency of current regulations.
- *On paying extra for the labeling of GM foods:* 52.2% say that they will not pay extra for the labeling of GM foods, whereas 34.1% are willing to pay extra.
- 45.5% report having used the general media to get or receive information on biotechnology at least thrice within a two-month period. 34.1% claim to have talked to experts, professionals, and scientists about the topic, and 25% have read books on biotechnology.
- Have sought information from these special interpersonal contacts at least 7.59 times.
- Are highly trusting of information that comes from university scientists, science magazines, newspapers, and websites.
- 70.45% think that information they have received concerning biotechnology is useful.
- 59.09% say that the information is highly scientific.
- Believe that moral or ethical arguments will influence their judgment most on biotechnology

## **G. The Philippine Policy Makers**

- Demographics: 52.6% percent male and 46.4 percent female; 14.4 percent are single and 81.4 percent are married. 23.7 percent have college degrees, 74.2 percent have grad/post graduate degrees. 33% live in an urban area, 38.1 percent suburban, and 26.8 percent rural.
- Highly interested in biotechnology
- Moderately to highly concerned about biotechnology issues
- Perceive the risks of biotechnology to be low
- Perceive the benefits of biotechnology to be between moderate to high
- Have a high regard for a) research institutes (78.30%), b) consumer advocacy groups/NGOs (74.3%) and c) university scientists (74.2%) as being highly concerned about public health and safety issues relating to biotechnology
- Believe that regulatory bodies (97%), research institutes (97%), university scientist (93.80%) and agri-biotech companies (93.80%) have total responsibility for conducting risk assessment and risk management on biotechnology.
- Have a very high regard for the role of science in the development of agriculture in the Philippines (96%)
- Rate themselves as having a moderate to high understanding of science

- Rate themselves as having a moderate understanding of biotechnology
- Generally have moderate mean score on factual knowledge about biotechnology
- Generally exhibit moderate attitudes toward biotechnology
- *On banning GM foods:* 75.3% are not in favor of being actively involved through either time or money in banning GM foods.
- *On labeling GM foods:* 61.8% think that GM foods should be labeled.
- *On benefits of biotechnology to small farmers:* 79.4% believe that agricultural biotechnology will benefit small farmers.
- *On the benefits of biotechnology to Philippine agriculture:* 78.4% believe that biotechnology is good for Philippine agriculture.
- *On the adequacy of biotechnology regulations in the Philippines:* 49.5% do not think that current biotechnology regulations in the Philippines are sufficient. 38.10% say that the current regulations are sufficient.
- *On paying extra for the labeling of GM foods:* 49.5% indicated that they would not pay extra for the labeling of GM foods, where as 38.1% would be willing to pay extra.
- Their sources of information on biotechnology are family and friends, experts, and special media such as pamphlets and brochures
- Have talked to specialized information sources at least 7.12 times in a two-month period.
- Are highly trusting of information that comes from science magazines, university scientists and websites
- 68.04% believe that the information they have received concerning biotechnology is useful.
- 60% say that the information they have received is highly scientific.
- 62.88% say that they will be influenced most by moral and ethical arguments

## H. The Philippine Scientists

- Demographics: 35.1% are male and 48.6% are female; 16.2% are single and 64.9% are married. 2.7% have college degrees, 81.1% have post graduate degrees. 10.8% live in an urban area, 59.5% suburban, and 13.5% rural.
- Moderately interested in biotechnology
- More than moderately concerned about biotechnology issues
- Perceive the risks of biotechnology to be moderate
- Perceive the benefits of biotechnology to be moderate
- Have a high regard for a) consumer advocacy groups/NGOs (70.27%), b) university scientists (64.86%) and c) private sector scientists (62.16%) as being highly concerned about public health and safety issues relating to biotechnology
- Believe that a) regulatory bodies (83.78%), b) university scientists (83.78%), research institutes (81.08%), and c) agri-biotech companies (81.08%) have total responsibility for conducting risk assessment and risk management on biotechnology.

- Have a very high regard for the role of science in the development of agriculture in the Philippines (83.78%)
- Rate themselves as having a moderate understanding of biotechnology
- Have received information through tri-media (24.40%), i.e., radio, television, and newspapers, experts (35.20%), and pamphlets (30%)
- Have sought information from special interpersonal contacts at least 5.94 times in a two-month period
- Are highly trusting of information that comes from science magazines, University scientists and websites at 87.62%, 83.5% and 74.22% respectively
- 64.86% feel that information they have received concerning biotechnology is useful. 13.50% feel that it is only somewhat useful and 2.7% feel that it is not useful
- When asked if they perceive the information they receive about biotechnology, 48.64% think that the information is highly scientific.
- 43.24% believe that they can be most influenced in their judgments of biotechnology by moral and ethical concerns

## V. SUMMARY AND CONCLUSIONS

This study confirms the assumptions made at its inception that stakeholders define and represent biotechnology according to their own interests and priorities. The future discourse of agricultural biotechnology will be determined in part by the varying frames as well as shared meanings that stakeholders have in assessing risks and benefits. Part of the effort in understanding the dynamics of these public discourses is identifying and examining the elements that constitute these distinctive and common meanings. Specifically, by noting the differences and similarities among Philippine stakeholders, the study establishes the character of the social environment in which discourses about agricultural biotechnology in the Philippines takes shape.

Interest and Concern. Results of the survey show that a majority of Philippine stakeholders report being either moderately or highly interested in agricultural biotechnology. They are also either moderately or very concerned about agricultural biotechnology. In particular, policy makers, journalists, businessmen, farmer leaders, and extension workers have all shown high interest in agricultural biotechnology. At least 70% of policy makers, businessmen, and extension workers believe that biotechnology is good for Philippine agriculture. Evidently, part of the motivation of these stakeholders arises from the nature of their roles in society. Biotechnology is a topic that they ought to know and learn about in order to effectively carry out their work, i.e., as

decision makers, opinion leaders, or educators. Philippine journalists, for instance, consider biotechnology as a very important news story.

Combined with their strong expressions of appreciation about the role of science in Philippine agricultural development, the level of interest in biotechnology among Philippine stakeholders should amount to a high degree of involvement. This implies a high degree of openness towards technology, in general, and a disposition to seek more information and learn more about biotechnology, in particular. Communication activities that reinforce this level of interest among highly involved stakeholders can focus on types of information that allow stakeholders to make informed judgments about the risks and benefits of agricultural biotechnology in the Philippines.

Consumers, religious leaders, and scientists have shown comparatively less interest and concern about biotechnology. Although it is quite understandable why consumers and religious leaders do not feel compelled to attend to biotechnology as much as the other stakeholders, it is quite intriguing to note the degree of interest that Philippine scientists have expressed in agricultural biotechnology, especially in the context of prevalent global discourse about the topic. Given the widespread coverage of biotechnology in the mass media and the new debates they spur, not just about biotechnology, but as the role of science in society in general, it would have been customary for Philippine scientists to be more attentive to the topic. Clearly, communication activities may have to be developed to get Philippine scientists actively on board considering their potential role in clarifying the scientific dimensions on biotechnology.

Perceived risks and benefits. Contrary to popular notions that there is widespread negative attitudes or public concern about the risks of biotechnology, survey results show that, in general, Philippine stakeholders do not really see biotechnology as posing high risks to public health and food safety.

Indeed, the majority of the Philippine stakeholders view agricultural biotechnology as having moderate to high benefits. This view is particularly evident among journalists, policy makers, extension workers, and businessmen. Compared to other stakeholders, religious leaders tend to be evenly split in their assessment of the risks and benefits of biotechnology. The relatively low degree of apprehension or negativity about agricultural biotechnology offers a head start for communication programs that seek to forge a better-rounded discussion on biotechnology. The farther away stakeholders move from judging biotechnology based on perceived “dreadfulness,” “loss of control,” and other general rules of thumb can only mean better opportunities for

stakeholders to gain information that allows them to think about the different facets of biotechnology, including its implications for agriculture and society. Philippine stakeholders seem to be accepting and ready for messages that deal with more holistic information on agricultural biotechnology.

Understanding and knowledge of science and agricultural biotechnology. Philippine stakeholders give themselves moderate ratings on their understanding of science and knowledge about agricultural biotechnology. Based on a pop-quiz of twelve statements on biotechnology to measure their knowledge on biotechnology, most of the stakeholders, except for religious leaders, have obtained moderate scores. Among those who obtained relatively, high scores on the pop-quiz are policy makers, extension workers, and farmer leaders. However, it must be noted that a majority of the Philippine stakeholders surveyed already have a college degree and have access to scientific information through various media. Evidently, for the general public who do not possess the same educational characteristics and information advantages, the level of understanding and knowledge about biotechnology will be much lower. The situation suggests a need for more stepped-up campaigns to inform and educate the public about agricultural biotechnology.

Attitudes toward agricultural biotechnology. In general, Philippine stakeholders take an overwhelmingly moderate position on agricultural biotechnology. No less than 60% of the stakeholders have expressed at least an above-moderate stance on biotechnology. However, there are no remarkable numbers to suggest strongly positive attitudes towards biotechnology. This may stem partly from the fact that while there is some interest in biotechnology, stakeholders do not have enough understanding and knowledge about it in order to make a definite position on the matter.

Trustworthiness and credibility of institutions. One of the major factors that have a sustaining impact on audiences is the extent to which they perceive sources of information as trustworthy and credible. Questions about biotechnology notwithstanding, Philippine stakeholders seem to have retained their trust in scientific organizations. They view research institutes as being concerned about health and safety issues on agricultural biotechnology, and five out eight stakeholders also perceive rather highly university scientists on par with consumer advocacy groups and NGOs as being concerned about the same issues.

Similarly, when it comes to stakeholders' beliefs on the institutions that can conduct risk assessment and risk management, science-based institutions are ranked way ahead of the other groups. Stakeholders regard regulatory bodies, research institutes, agri-biotech companies, and university scientists as being very responsible for assessing and managing the risks relating to agricultural biotechnology.

Sources of information. Philippine stakeholders exhibit rather dismal information seeking behaviors. This can be due to several factors: a) they do not know where to go to for information, b) the mass media does not adequately cover it, c) people do not talk much about biotechnology because it is too complex, and d) issue has not yet reached a level of salience that can motivate people to seek additional information. Journalists, businessmen, policy makers, and scientists tend to gather information on biotechnology from both mass media and interpersonal sources much more frequently than the other stakeholders do. Religious leaders hardly gather information on biotechnology, which then implies the type of campaign they wage on biotechnology issues.

When asked about the sources of information they trust most, Philippine stakeholders have cited university scientists as very trustworthy sources, followed by science magazines and websites. Indeed, stakeholders place a premium on university scientists in a number of areas. University scientists are regarded as sympathetic to public health and safety issues, possessing the expertise to conduct risk assessment and risk management, and trustworthy sources of information on biotechnology. The survey data appears to suggest that university scientists can be very effective agents for educating the public about agricultural biotechnology.

Factors that can influence judgments about biotechnology. Although they have heard or know about the scientific aspects of agricultural biotechnology, a majority of the stakeholders have said that they have also heard or know about moral and ethical arguments being raised on biotechnology much more than cultural, religious or political arguments. A majority of the stakeholders also considers moral and ethical issues of biotechnology as having much influence on their judgments of biotechnology followed by cultural considerations.

Making judgments on biotechnology.

a) Policy frames: There is apparent interest among policy makers in the Philippines to focus on specific biotechnology applications and benefits as part of the decision making process. They intend to frequently talk about the use of biotechnology to make crops resistant to pests and diseases in order to improve food quality. They will also take into account biotechnology's

impact on increasing farm productivity and improving crop production. In terms of the medical applications of biotechnology, policy makers have reported being interested in focusing frequently on the use of biotechnology to produce medicines and vaccines, and study human diseases like cancer.

Clearly, there is an effort among policy makers to balance their decisions when it comes to the environmental effects of biotechnology. While a clear majority of policy makers has said that they will emphasize the safety of GM foods, also a sizable number will tend to look at the arguments both ways especially on those issues pertaining to biodiversity.

b) Journalistic frames: In general, Philippine journalists seem to take a rather ambivalent or cautious approach to covering biotechnology, especially in terms of highlighting its potential benefits. There seems to be a tendency among journalists, however, to talk much more frequently about specific benefits and topics such as the safety of GM crops, use of biotechnology to improve crop production, use of biotechnology to make crops resistant to pests and diseases (61.4%), and use of biotechnology to increase farm productivity. Philippine journalists are not quite keen on reporting about medical applications of biotechnology.

Perhaps owing to the nature of the profession to constantly write or talk about both sides of the issue, journalists say that they will talk about the impact of biotechnology on biodiversity, especially on the issue of pest-resistant GM crops as harming non-target organisms like butterflies. They will find it hard not to say anything about the idea that there are no evidence GM crops can harm the environment.

c) Scientific frames: Philippine scientists are rather very cautious in talking about the biotechnology applications and issues. There is clearly more support among scientists for the applications of biotechnology in crop production than in medical applications owing perhaps to the nature of the respondents, most of whom are university-based scientists/teachers in predominantly agricultural colleges and universities. For example, scientists have reported an interest in frequently talking about the use of biotechnology to make crops resistant to pests and diseases, increase farm productivity, and improve food quality.

On the other hand, scientists tend to balance benefits with questions about the effects of biotechnology particularly on the environment. For instance, they will frequently discuss the issue of pest-resistant GM crops as being harmful to non-targeted organisms like butterflies,

biotechnology's negative impact on biodiversity, and the idea that biotechnology might push native plants into extinction.

There is not as observable enthusiasm among scientists in dealing with the medical applications of biotechnology.

The main purpose of this monograph is to provide an empirical profile of key Philippine stakeholders. This baseline data offers a good starting point for communication strategists, policy makers, planners, decision makers, and other researchers interested in understanding some of the important contexts that drive public perceptions, knowledge, attitudes, and information-gathering behaviors of Philippine stakeholders in relation to agricultural biotechnology. The data is not by any means exhaustive, and the contextual interpretations that have been discussed in the monograph are partly meant to motivate readers to offer their own reflective insights, analyses, and explanations for the patterns they may now be able to see based on the survey data. Social science research on public understanding of biotechnology deals with a plethora of amorphous variables. Evidently, the sheer complexity of these social phenomena cannot be totally captured by survey research. Indeed, the survey data that we thought can provide answers are clearly leading us to questions that are more complex. In the final summative and integrative monograph that compares the data across five countries in Southeast Asia, we will discuss the next possible direction for research on public representations of agricultural biotechnology.

For now, we hope that this monograph can be a useful reference to both practitioners and scholars interested in learning about some of the key elements that shape public discourse on agricultural biotechnology in the Philippines.

## VI. COMMENTARIES

### **Filipino Stakeholders' Views and Beliefs on Agri-Biotech Applications: A Personal Perspective**

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Since literally the dawn of creation, making (or manufacturing or cloning) new stuff has been fraught with controversy. Most religious believers tend to view creation as the sole right of God (or gods), while many science practitioners attest that creation is but a natural act—and an appropriate domain of mankind. Witness the heated battles over evolution versus creationism, artificial versus natural birth control, and now, organic versus genetically-modified (GM) foods, among others.

I have had personal experience of such polarization—in my twin roles of science professor and science journalist. In my Popular Science classes (which I have been teaching off and on since 1995) at the Ateneo de Manila University, I have listened to students debating about the pros and cons of biotechnology and genetic engineering. More often than not, they have followed my instructions to base their reasoning on up-to-date and sound research (journal articles, science magazines like *Discover* and *Popular Science*), and for this, I am grateful. I have always believed that there are two sides to every issue—and that sometimes, the gray area is the most intelligent one.

In September 12, 18, and 26, 2001, under my “Eureka!” column, I ran a series of articles on the benefits of biotechnology in the *Philippine Daily Inquirer (PDI)*. I quoted liberally from the research reports given by the National Academy of Science and Technology. Their reports happened to be reasonable, well thought out, heavily researched—and I expected no less from the premier science advisory body in the Philippines. The reports also concluded that with safeguards, the benefits of this technology outweigh the possible dangers.

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<sup>19</sup> Dr. Queena Lee-Chua is an award-winning writer and author. Recently, she was named one of the Philippines' Outstanding Young Scientists. A very well-respected teacher and well-loved mentor, Dr. Lee-Chua teaches Mathematics and Psychology at the Ateneo de Manila University.

I immediately received loads of reader mail—71 so far to date. The letters and emails came from students, teachers, housewives, engineers, and the general public. Half of them praised my arguments (“rigorous”, “insightful”, “not sensationalizing” were some of the phrases used). The other half (many of which were anonymous) questioned my integrity as a journalist, and accused me of being in the pay of drug manufacturers and agricultural companies. Answering the latter back in a heated manner would have been useless, since they seem to have already closed their minds to any other form of argument. I just wondered how the same articles could provoke such differing reactions in different groups of people.

A year after, in July 24 and 31, 2002, under my “Mind Games” column, I ran a series on biotechnology in GMA7-Inq Interactive, [www.inq7.net](http://www.inq7.net) (the official website of *PDI*) this time focusing on fears and concerns aired by some Australian scientists. This time I quoted liberally from *Third World News Features*, an international NGO publication, forwarded by my colleague Dr. Norman Quimpo of the Mathematics Department, who admitted that he was on the “con” side of the debate. As a journalist, I wanted to give equal airing to both sides of the issue. This time I got another flurry of responses, and the same thing occurred. Half now said I “saw the light” and another half felt “betrayed, since didn’t you write positively about it before?” Again what saddened me was that people seemed to have closed their minds and would not admit anything from the opposing side. (Also, did there really have to be two sides in the first place? I firmly believe that rapprochement and communication can and should be established.)

Therefore, I was not surprised by the results of the ISAAA Stakeholder Survey. Across the board, most of the respondents indicated that they were highly interested and concerned about biotechnology. (Even among religious leaders--the ones who had the lowest scores in interest and concern--only around 20% were in the low category.)

As for perceived risks and benefits, because of my personal experiences, I expected the respondents to be split in half (meaning most of them would choose “moderate”), and this is what the survey shows. In fact, for perceived benefits, many even chose the “high” category. Perhaps the urban consumers, businessmen, extension workers, farmer leaders, policy makers, and scientists interviewed (in the sample) received more information regarding this and were able to weigh the pros and cons. (They remind me of my college students who researched about biotechnology before judging either way.)

The only ones to deviate from these were the religious leaders (but not too much), and traditionally this would make sense. Cloning (especially) has negative connotations these days, and the frenzied side effects of GM foods have concerned many people. In the Philippines, where religious leaders often exert influence way beyond strictly church issues, I am not surprised to see them becoming wary of this technology, especially if they believe that it can be abused.

One observation that puzzled me for a while was the journalists' high group average on both perceived risks and benefits. (Statistically, these scores also were significantly different from everyone else's.) How could someone be both pro and con at the same time? I wondered about this, until I realized that I myself might have scored the same. Because journalists have to keep abreast with news, the Filipino journalists here might have been influenced by the negative publicity from European media (Monsanto et. al) about GMOs, but at the same time, they were also aware of research showing the benefits.

Again I narrate another personal experience: When I gave a talk at the First Philippine Science Journalists Congress last May 2002 (under the auspices of the Science Technology Information Institute, the media arm of the Department of Science and Technology), I exhorted these journalists to be fair, to check their sources, and to present the different sides of any issue. I mentioned genetic engineering as an example, and asked them to research on the various perspectives. Most journalists were nodding at this, and later some participants who said that from then on, they would be talking to more scientists first before taking sides accosted me.

Thus, perhaps due to their access to different sources of information, journalists tend to feel strongly about both the risks and benefits—and to paradoxically, manage to hold seemingly opposite views at the same time. Of course, they would rate biotechnology as big news, as the survey points out.

Yet, mass media did not score high in people's trust as an information source. One-third of consumers rated them high, another 1/3 moderate, and the other 1/3 low (it is no wonder that journalists gave themselves the highest score). I wonder why scientists were not asked. In the next survey, it might be instructive to include scientists' responses. Websites scored higher than newspapers, TV, or radio; and thank goodness, science magazines scored quite high. More disturbingly, these results mirror the actual situation. There has not been enough information from mass media about biotechnology, as measured by the responses of other stakeholder groups.

These results held not just for journalists, but for other sources as well. I was disturbed to find out that though scientists would engender more trust, they did not seem to be communicating to the public about their stance on these issues. Neither were local NGOs—surprisingly--since I believe foreign NGOs are quite vocal about their views. We don't hear a lot from politicians, food regulators, and even agribiotech companies. Books are not widely available, and pamphlets are not enough. If everyone seems to be interested in biotechnology, why hasn't there been more discussion about this?

Since there seem to be little coherent information coming from any side, then it comes as no surprise that Filipinos' knowledge would not wholly be accurate. The majority of respondents rated themselves moderate in terms of biotechnology knowledge, but I was amused to discover that many (except religious leaders) placed themselves in the "high" category regarding scientific knowledge in general. This misplaced pride in their scientific knowledge could easily be contradicted by our dismal international rankings in science tests (for instance, we were near the bottom in the Third International Mathematics and Science Survey).

Moreover, the perceived self-knowledge is now called into question by the results of this survey (on their actual personal knowledge)—none of the groups scored as high as they thought they would. Only religious leaders seemed to be realistic in their self-assessment. Again, this was quite expected. In my classes at the university, most students would rate themselves as knowing more than they really did.

What can we conclude from all these? The conclusion is (again) not surprising. More accurate information about biotechnology and its effects on agricultural production is needed by all sectors. More discussions should be initiated among the different stakeholders before wrong notions about biotechnology lead to erroneous policy, widespread misconceptions, and general public confusion. No one is exempt.

**Biotechnology: What It Means for You and Your Future**  
(Notes on the ISAAA-UIUC Survey of Opinions About Biotechnology in Food Production)

Dr. Gelia T. Castillo<sup>20</sup>  
Professor Emeritus  
University of the Philippines at Los Baños

This paper presents the highlights of responses of eight Philippine stakeholder groups composed of consumers (169); businessmen (54); extension workers (92); farmer leaders (57); religious leaders (56); journalists (44); policy makers (97); and scientists (37). The opinion survey covered such topics as: stakeholder concerns about uses of biotechnology in food production; knowledge and opinions about biotechnology in food; sources of biotechnology information and reactions to different views and perspectives about biotechnology. The focus of the analysis is on trends (tendencies), which have implications for future actions; for selecting target audiences for IEC activities; for choice of content in communication materials and for improving utilization of existing information sources. Although the mean scores and percentages arrived at present an aura of precision up to the second decimal point, the numbers are more appropriately regarded as numerical values for ranking responses and comparing stakeholders groups. They are indicative rather than definitive for possible courses of action to take. The trends and directions suggested by the numbers are more important than their exactitude.

**A. Interest and Concerns About Uses of Biotechnology in Food Production**

Interest in the uses of biotechnology in food production is relatively high amongst stakeholders with almost 60% to 78% indicating high interest except for religious leaders, only 37% of whom expressed high interest. Policy makers, journalists, and businessmen are the stakeholder groups that topped the list. Scientists ranked seventh and religious leaders eighth.

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<sup>20</sup> Dr. Gelia T. Castillo is a noted scientist, and a well-known and respected Filipino rural sociologist. She was conferred the Rank and Title of National Scientist in October 1999, and still serves the University of the Philippines Los Baños as a University Professor Emeritus. She received her AB Psychology from the University of the Philippines, magna cum laude and holds an MS degree in rural sociology from the Pennsylvania State University and a Ph.D. from Cornell University. She is currently an honorary member of the Training Institute at the International Rice Research Institute in Los Baños.

The latter is expected but the former is not. Scientists also registered the most “no answers” (16%)<sup>21</sup>.

When asked to describe their personal concern about biotechnology uses in food production, journalists were the least personally concerned, and most concerned were extension workers, policy makers, farmer leaders, and businessmen (in that order). Scientists were sixth and again, they had the most “no answers” (19%). It is important to point out that interest in the uses of biotechnology was higher than personal concern.

In other words, biotechnology in food production is more a matter of interest than a personal concern. However, except for religious leaders (37%) and journalists (25%), the six other stakeholder groups registered more than 50 to 75% high personal concern.

1. In general, perceived benefits associated with the uses of biotechnology in food production was higher than perceived risks. Journalists and policy makers saw the most benefit but the latter also perceived the least risk. It can be inferred that policy makers saw the most benefits of the eight stakeholder groups. On the other hand, journalists who perceived the most risks also saw the most benefit. It is a two-headed perhaps schizophrenic perspective for journalists. In other words, for them what is considered risky is also perceived to be beneficial. Furthermore, journalists were the least personally concerned about biotechnology. They view biotechnology mainly as NEWS (82% of them). It is not something they are personally concerned with. As the Filipino saying goes: “Trabaho lamang. Walang personalan.” (It’s only a job. Nothing personal about it.)

About a fourth and a fifth of the scientists gave “no answer” to the issue of risks and benefits respectively. Except for religious leaders, seven stakeholder groups perceived more benefits than risks although scientists perceived less benefits than extension workers, journalists and policy makers. Religious leaders perceived the least benefit.

2. Different organizations and institutions are perceived differently with respect to their concern about public health and safety of biotechnology. For the entire stakeholder groups there were more “High” than “Moderate” assessment of the nine<sup>22</sup> institutions and organizations. However, some received more “high concern” responses than others did.

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<sup>21</sup> In this commentary, Dr. Castillo includes the full range of data including “Don’t know” and “No Answer” responses. It is felt that these responses are important to Dr. Castillo’s corresponding analysis, but are not included in the tables presented.

<sup>22</sup> “Research Institutes” was not an option for all of the stakeholders of each country, and was therefore not included in the original table. Dr. Castillo chose to include this option for her analysis, but decided to eliminate mass media for similar reasons. For the complete table used by Dr. Castillo, see appendix 2, Table 2.1

Pooled responses showed the following rankings:

1.	Research Institutes	76.29%
2.	University Scientists	67.83%
3.	Consumer Groups & NGOs	66.88%
4.	Agri-biotech Companies	60.04%
5.	Private Sector Scientists	59.27%
6.	Religious Groups	55.91%
7.	Farm Leaders	53.03%
8.	Mass Media	48.60%

3. The “high” rank of research institutes in their concern about public health and safety with Regard to agricultural biotechnology is understandable. Consumer groups and NGOs ranked next to university scientists who were perceived as more concerned than agribiotech companies and private sector scientists.<sup>23</sup>

Of all the stakeholders, scientists registered the highest percentage of NOT SURE responses. Furthermore, they perceived consumer groups and NGOs (70.27%) more favorably than university scientists (64.86%) with respect to concern about public health and safety of agricultural biotechnology.

4. When asked how much responsibility different organizations and institutions should have in assessing and managing the risks and benefits of agricultural biotechnology from “not at all responsible” to “totally responsible,” the following indicative rankings pooled percentages of “High” responses emerged<sup>24</sup>:

1	Regulatory Bodies	88.03%
2	Research Institutes	87.36%
3	Agri-biotech Companies	84.88%
4	University Scientists	81.20%
5	Private Sector Scientists	75.44%
6	Consumer Groups and NGOs	64.69%
7	Local Farm Leaders	61.37%
8	Religious Leaders	52.54%

The proportion of respondents from all stakeholder groups who assigned “high” degree of responsibility to the first 5 institutions cited above is quite high suggesting some consensus as to whom should be responsible. Policy makers (92 to 97%) were particularly definitive about the high level of responsibility they assign to these five institutions. Consumer groups and NGOs and

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<sup>23</sup> Dr. Castillo felt it pertinent to address “low” concern as well as “high” concern. See appendix 2, Table 2.1 for the full range of data.

<sup>24</sup> Rankings 5 through 9 can be found in Dr. Castillo’s analysis only. See appendix 2, Table 2.2 for the full range of data.

who were perceived as highly concerned about the public health and safety of agricultural biotechnology did not escape responsibility for assessing and managing the risks and benefits. Nearly 65% of stakeholders groups assigned high level of responsibility to the consumer and NGO groups. In general, aside from science-based institutions, consumer groups & NGOs, local farmer leaders, and religious were also given high responsibility for risk assessment and risk management.

In many ways, the findings are encouraging for they suggest almost societal-level responsibility for the risks and benefits of agricultural biotechnology. Although more of the R & D groups were assigned the high degree of responsibility, other organizations do not escape responsibility. Perhaps the media attention to the issues has generated more public awareness, interest, and sense of responsibility. This is something different from the usual. “Let’s leave it to government!” stance.

## **B. Opinions and Knowledge about Science and Biotechnology**

Except for 5 percent of the religious leaders, none of the seven stakeholder groups said: “Science should not play a part in the development of agriculture in the Philippines.” The role of science received high endorsement from all groups, particularly extension workers, farmer leaders, policy makers, and journalists (93 to 97%). Scientists (84%) assigned a high role for science in agricultural development but 16 percent of them gave “No Answer<sup>25</sup>.” Self-rated understanding of science is higher than moderate and is higher than self-rated knowledge on biotechnology. Extension workers had the most “high” self-ratings on biotechnology (39%). Religious leaders had the lowest self-rating in knowledge on biotechnology and in understanding of science and in factual knowledge on biotechnology. Policy makers had the highest factual knowledge on biotechnology and in self-rated understanding of science. For five stakeholder groups, factual knowledge on biotechnology was higher than self-rated knowledge. This is counter-intuitive. They know more than what they think they know when asked about the everyday facts about biotechnology.

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<sup>25</sup> In this commentary, Dr. Castillo includes the full range of data including “Don’t know” and “No Answer” responses. It is felt that these responses are important to Dr. Castillo’s corresponding analysis, but are not included in the tables presented.

In terms of overall attitudes toward biotechnology, seven stakeholder groups were mostly moderate (57 to 83%) but religious leaders were more on the “low” side. Policy makers, journalists, and extension workers had slightly more favorable attitudes toward biotechnology.

Although stakeholders had highly positive perceptions of the role science should play in Philippine agricultural development they are not as convinced that agricultural biotechnology will benefit small farmers. Religious leaders, and even farmer leaders, businessmen, consumers, journalists, consumers and policy makers (55 to 21%)<sup>26</sup> do not agree or do not know whether agricultural biotechnology will benefit small farmers. Those who believe otherwise are from 45% (religious leaders) to 79% (policy makers). To the question on whether biotechnology is good for Philippine agriculture, the “agree” responses are from 52% of religious leaders to 78% of policy makers and businessmen. Forty-eight percent of religious leaders; 41% of consumers, 37% of farmer leaders and 32% of journalists do not believe or do not know whether biotechnology is good for Philippine agriculture.

Stakeholders’ perception of the sufficiency of current biotechnology regulations is even less favorable with more than half of respondents from seven stakeholder groups indicating that current biotechnology regulations are not sufficient or they do not know whether they are. In a manner of speaking agricultural biotechnology (often equated with GM crops) is in a “Catch 22” situation. Because GM crops are not yet commercially grown in the Philippines, people do not have an opportunity to feel and experience the benefits to small farmers. Furthermore, the current regulations have not yet been put to a real test of sufficiency for all we have had are field trials. Except for Bt cotton in China and some beginning story in South Africa, the evidence of benefit to small farmers remains to be seen especially for food crops.

### **C. Factual Knowledge About Biotechnology in Food Production**

Except for policy makers and extension workers who obtained higher than moderate scores on the knowledge questions, the 5 other stakeholder groups only scored “moderate” with almost 40% of religious leaders being in the low category.

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<sup>26</sup> These percentages (as indicated by Dr. Castillo) are formulated by including the “Don’t know” response in the percentage formulation. As previously mentioned, Dr. Castillo includes the full range of data including “Don’t know” and “No Answer” responses. It is felt that these responses are important to Dr. Castillo’s corresponding analysis, but are not included in the tables presented.

The interesting findings are as follows<sup>27</sup>:

- a) Respondents recognize that every new technology carries potential risks.
- b) Science cannot guarantee zero-risk.
- c) It is encouraging that from 75 to 91% of the seven stakeholder groups understood the basic concept of “genetic engineering, which transfers genes of interest from one organism to another.” Almost as many know that “Yeast for brewing beer consists of living organisms.”
- d) More than 80% of stakeholders know that GMCs are now being commercially grown in other Asian countries but about 40 to 65% of them thought that these crops are now commercially grown also in the Philippines. This is clearly a case of misinformation. Perhaps the media hype about the field trials of Bt corn had led people to believe that GMCs are already commercially grown in the country. This is one error of fact, which needs to be corrected as soon as possible.
- e) The matter about whether ordinary tomatoes contain genes; whether eating GM rice could modify a person’s genes; whether all crops have been genetically modified through the years; whether half of human genes are identical to those of a monkey; and whether GM rice contains beta-carotene are statements which received high percent of wrong answers. They deserve more explanation in ways that are more comprehensive because we need to address misinformation which people have.
- f) Just as important as the wrong answers are the Don’t Know answers for they definitely indicate areas where more information is needed. Most “Don’t Know” answers occurred in similar statements, which received many wrong answers. These are: whether GM rice contains beta carotene; whether half of human genes are identical to those of the monkey; whether by eating GM rice, a person’s genes could also be modified; whether GM crops are now being grown commercially in the Philippines; whether all radio-activity is man-made; whether ordinary tomatoes do not contain genes; and whether yeast for brewing beer consists of living organisms.

**D. Information Sources: Patterns of Use; Trustworthiness; Perceived Usefulness and Scientific Quality**

If people were to become knowledgeable about biotechnology in food production, where would relevant information come from? The survey listed 12 possible sources: media, family, friends, and neighbors; religious figures; experts on the subject; NGOs; local politician or leader; website; books; newsletters, brochures, pamphlets; food regulators; public fora; and agribiotech companies. Scientists were not the highest information-users, journalists as mentioned earlier treat biotechnology as news, and therefore information is used for that purpose. Policy-makers, businessmen, and extension workers came after journalists.

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<sup>27</sup> See Appendix 2, Table 2.3 for a full copy of the “Pop-quiz” which is the basis for part C of this commentary.

Except for journalists, policy-makers, businessmen, and scientists whose use of media, experts, brochures/newsletters is moderate and high rather than low, all other stakeholders were low in frequency of contact with information sources<sup>28</sup>. In other words, information – seeking about biotechnology in food production is infrequent. The web-site which many are counting on to bring biotech information to those who want and need to be informed is not yet a popular source. For those who have attended many biotechnology seminars, and think that there is too much public speaking in the subject. Only about 30% of businessmen, journalists, policy makers, and scientists have moderate and high attendance in such fora. Consumers and religious leaders have the lowest attendance in public fora. A lower percentage of stakeholders have talked to or heard from agribiotech companies although businessmen, journalists, policy makers, and extension leaders have had more contacts with them than other stakeholders.

Based on frequency distributions, the different information sources can be ranked as follows with respect to frequency of use:

1. Media
2. Experts
3. Newsletters
4. Family, friends, and neighbors
5. Book on biotechnology
6. Web-site
7. Agribiotech companies
8. Seminars and public fora
9. NGOs
10. Food regulators
11. Religious figures
12. Local politician or leaders

Stakeholders' patterns of most frequent information use provide us some practical insights. Mass media were most frequently contacted information source for all stakeholders except policy makers. The latter seem to be most “scientific” and professional in their use of information source. Consumers, farmer leaders, religious leaders, and journalists included family, friends, and neighbors as most frequent source but only religious leaders mentioned NGOs as most frequent source. Six stakeholder groups also cited experts as most frequently used contact. Farmer leaders and religious leaders did not have frequent contact with experts.

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<sup>28</sup> Dr. Castillo includes the full range of data including “moderate” and “low” responses. It is felt that these responses are important to Dr. Castillo’s corresponding analysis, but are not included in the tables presented. See appendix 2, Table 2.4 and Table 2.5 for the entire data set.

High users of information are not exactly the same as the most trusting of such information sources. For example, consumers who are low users (no. 7) turn out to be more trusting (No. 3) in their sources of information. On the other hand, religious leaders who are low users also have low trust in their information sources.

The next question seems to be: “What is the connection between most frequently contacted source and most trusted information sources?” These two factors are not in perfect synch. Although mass media sources are most frequently contacted, they are not the most trusted. Furthermore, national newspapers are more trusted than television broadcasts and radio broadcasts are least trusted of the three mass media outlets.

University scientists, science magazines, and biotech-websites are most trusted although not as frequently used as mass media. NGOs are not often contacted and also not much trusted.

University scientists who represent expertise and science magazines, which report science, were most trusted by seven stakeholder groups. Website although not frequently used is highly trusted by consumers, extension workers, and policy makers. Not to be neglected is the fact that NGOs were most trusted by farmer leaders and religious leaders, although not frequently contacted.

#### **E. How useful were the various information sources to the different stakeholders?**

Data indicate that more than half of the total respondents found the biotechnology information from various sources “very useful.” Journalists, policy makers, extension workers, more than others were the groups who perceived their usefulness. Farmer leaders, consumers, and religious leaders were the groups who found them less useful.

About the scientific quality of the biotechnology information which they used, about half of the total respondents thought the information was highly scientific about 30%, moderately scientific; and more than 10%, not at all scientific. The rest had no answers. Notable again, are the scientists who had almost 20% “no answer<sup>29</sup>.” Farmer leaders and religious leaders perceived lower scientific quality.

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<sup>29</sup> Dr. Castillo includes the full range of data including “Don’t know” and “No Answer” responses. It is felt that these responses are important to Dr. Castillo’s corresponding analysis, but are not included in the tables presented.

When asked about what other issues/concerns they have heard or known about biotechnology, moral/ethical issues were most frequently mentioned, followed by cultural, political, and religious. The same issues in the same order of importance were mentioned, as the issues, which stakeholders think, would influence most their judgments on biotechnology.

This is a very significant finding i.e. food biotechnology is not just a science, agricultural productivity or economic issue but a multi-factored issue which makes communication about public acceptance more complicated and sensitive. What makes the subject doubly difficult in the Philippines is the fact that food biotechnology particularly GM crops are more “theoretical” than “real” because we do not yet have them commercially planted. “Seeing is believing” is not operative because we have had only field trials, which few people have witnessed.

#### **F. Biotechnology Applications Stakeholders Tend to Focus on when Making Decisions About Biotechnology**

One notices that policy makers tend to focus more on the positive aspects of food biotechnology such as more nutritious; more production; pest resistance; medicine and vaccine uses; food safety etc. Journalists focused more on the negative aspects such as: biodiversity reduction; extinction of native plants; harm to non-target organisms, etc.

When covering or reporting on biotechnology, journalists seldom report for mass media coverage, such things as: “no evidence GM crops can harm environment” “no factual evidence for claims of negative health and environment consequences”; biotechnology products for medicines and vaccines; more nutritious food, etc.

Scientists when talking about biotechnology were less focused on biotechnology applications than policy makers and journalists. For the 14 applications they were asked to consider, eleven were less focused on than the other two stakeholder groups. Worth noting is the fact that scientists had the most “Don’t Know”, almost 20 to 30% and even more than 50% on the issue of “pushing native plants into extinction.” The biotechnology applications which were the least focused on for the 3 groups was ‘introducing fish genes into strawberries for resistance to freezing.’ Apparently, a fish gene into strawberries is difficult to imagine.

Other dimensions of food biotechnology which stakeholders would consider in making judgments on biotechnology. Consumers were more concerned about usefulness; businessmen, about moral acceptability; religious leaders about risks; and extension workers/farmer leaders

about applications which were to be encouraged e.g. more nutritious food; resistance to pest and diseases; insulin for diabetes; study of human diseases like cancer by modifying genes of laboratory animals. The latter is one application more consumers endorsed as “to be encouraged” and 57% of religious leaders considered this biotechnology application in the same way. In fact, two of the six applications presented to the respondents, which were considered as more useful by religious leaders than the other four, were human disease related. What is most intriguing is that businessmen had the least focus on usefulness compared to four other stakeholders groups. They had the most focus on moral acceptability, certainly much more than even the religious leaders.

### **G. Attitudes toward Different Aspects of Food Biotechnology**

Overall, attitude scores are moderate. Based on mean scores, policy makers were most positive about food biotechnology followed by extension workers, consumers, and businessmen. Surprisingly, journalists were only fifth in positive attitude but predictably, farmer leaders and religious leaders were least positive about food biotechnology.

There are four attitude significant statements, which received very high endorsement from seven stakeholder groups (83 to 93%). These are<sup>30</sup>:

- 1) Consumers have a right to choose what they eat, hence to know what they are eating. (Agree)
- 2) The public should be consulted in the formulation of food regulations and laws. (Agree)
- 3) Regulations on biotechnology should include inputs from NGOs (Agree)
- 4) The Philippines should be allowed to decline imports of GM products if little is known about their safety (Agree)

Agreement with these statements by a very high percentage of all the stakeholders is probably a reflection and product of advocacies by NGOs and other sectors of society, which featured, prominently in national media. They are very much an expression of “rights” to choose; right to participate; right to information; and right to reject if safety is unknown. It can be said that these are products of social activism associated with the debates on food biotechnology. However, they are not easy to implement. The latter is expressed in the statements about: holding back vital information about health effects of GM products; new allergies or contaminations; as threats to

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<sup>30</sup> These four statements are part of a group of 25 statements used to assess the stakeholders’ attitudes about biotechnology.

public health; ban on GM products unless they are totally safe; food biotechnology only benefits large companies and GM products should be labeled. Negative attitudes conveyed by these statements should be addressed by facts and explanations. For example, an ordinary lay person thinks of labeling as a simple act of sticking labels on the packages of GM products. A detailed elaboration on what is required in labeling makes a person realize how complex and expensive the entire process is. Transparency in the known health effects and the different beneficiaries of GM products is needed to minimize suspicions and change images of large companies as the only sector which reaps benefits from the technology.

The attitude statements, which are most supportive of food biotechnology, should be reinforced in information, communication, and education campaigns. Equally important in communication are the attitude statements, which received many Don't Know responses<sup>31</sup>. Stakeholders either have an information gap or they face a dilemma particularly with respect to the more controversial issues.

## ***SUMMARY***

The survey of eight Philippine stakeholder groups' opinions about biotechnology in food production showed the following:

- 1) Although interest in the uses of biotechnology for food is relatively high and so is their personal concern, the stakeholders differed in their level of interest and concern. Policy makers and extension workers topped the list while religious leaders were least interested and journalists, least personally concerned.
- 2) In general, perceived benefits associated with the uses of biotechnology for food is higher than perceived risks.
- 3) Research institutes were ranked highest in perceived concern about public health and safety but consumer advocacy groups/NGOs and university scientists ranked next as being perceived to be "very concerned" about public health and safety.

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<sup>31</sup> Dr. Castillo includes the full range of data including "Don't know" and "No Answer" responses. It is felt that these responses are important to Dr. Castillo's corresponding analysis, but are not included in the tables presented.

- 4) Scientific and regulatory bodies were assigned high degree of responsibility in assessing and managing risks and benefits of agricultural biotechnology.
- 5) The role of science in the development of Philippine agriculture received high endorsement by all groups but they were not as convinced that agricultural biotechnology will benefit small farmers and that current biotechnology regulations are sufficient. Self-rated understanding of science is more high than moderate. Factual knowledge about biotechnology is moderate but policy makers and extension workers ranked high.
- 6) Frequency of contact with information sources about biotechnology is low. Mass media; experts; newsletters; brochures etc. were most frequently used but most frequently contacted sources were not necessarily the most trusted sources. University scientists and science magazines including websites were most trusted although the latter is not yet frequently used. Farmer leaders and religious leaders cited NGOs as most trusted source, next to university scientists. More than half of the respondents found biotechnology information useful and regarded them as highly scientific. However, farmer leaders and religious leaders perceived these information sources as of lower quality and usefulness.
- 7) Moral/ ethical issues were most frequently mentioned concerns and were the issues stakeholders think would influence most their judgments on biotechnology. On biotechnology applications they tend to focus on when making decisions on biotechnology, policy makers tended to focus on the more positive aspects while journalists focused on the more negative aspects.
- 8) Regarding other dimensions of food biotechnology which stakeholders would consider in making judgments on biotechnology, consumers were more concerned about usefulness; businessmen, about moral acceptability; religious leaders about risks; and extension workers, farmer leaders about applications which were to be encouraged.
- 9) Overall, attitude scores toward biotechnology are moderate with policy makers and extension workers most positive. Four attitude statements, which are expressions of right to choose, to participate, to be informed, and to be safe, were most endorsed.

Although in general, respondents' views about agricultural biotechnology are positive, stakeholders have different opinions about different aspects of the subject. There are also enough knowledge gaps, negative perceptions, misinformation, "Don't Know" and "Unsure" responses

which warrant careful attention in designing information, education, and communication programs to improve knowledge, attitudes and acceptance of agricultural biotechnology. It will take more than mass media to address issues and to develop trustworthiness and credibility of information sources. The “beyond science” and the moral/ ethical dimensions of agricultural biotechnology are equally challenging.

APPENDIX 1: SUMMARY OF SOCIO-DEMOGRAPHIC CHARACTERISTICS OF  
PHILIPPINE SURVEY RESPONDENTS

*SEX*

	<b>Male</b>	<b>Female</b>	<b>No Answer</b>
Consumers (169)	49.7	49.1	1.2
Farmer Leaders (57)	59.6	36.8	3.5
Extension Workers (92)	40.2	56.5	3.3
Journalists (44)	40.9	52.3	6.8
Policy Makers (97)	52.6	46.4	1.0
Scientists (37)	35.1	48.6	16.2
Religious Leaders (56)	80.4	16.1	3.6

*MARITAL STATUS*

	<b>Single</b>	<b>Married</b>	<b>Separated</b>	<b>Divorced</b>	<b>Widowed</b>	<b>No Answer</b>
Consumers (169)	50.30	43.20	0.6	1.2	3.6	1.2
Farmer Leaders (57)	17.5	77.2	0	0	1.8	3.5
Extension Workers (92)	15.2	78.3	1.1	0	2.2	3.3
Journalists (44)	31.8	52.3	2.3	0	6.8	6.8
Policy Makers (97)	14.4	81.4	0	0	2.1	2.1
Scientists (37)	16.2	64.9	2.7	0	0	16.2

*EDUCATIONAL ATTAINMENT*

	<b>High School</b>	<b>Associate Degree</b>	<b>BS Degree</b>	<b>Grad/ Post Grad Degree</b>	<b>No Answer</b>
Consumers (169)	6.5	3.0	79.3	8.9	2.4
Farmer Leaders (57)	17.5	1.8	52.6	22.8	5.3
Extension Workers (92)	0	0	64.1	31.5	4.3
Journalists (44)	2.3	52.3	38.6	0	6.8
Policy Makers (97)	0	0	23.7	74.2	2.1
Scientists (37)	0	0	2.7	81.1	16.2

*AREA OF RESIDENCE*

	<b>Rural</b>	<b>Suburban</b>	<b>Urban</b>	<b>No Answer</b>
Consumers (169)	11.2	14.8	71.6	2.4
Farmer Leaders (57)	52.6	17.5	19.3	10.5
Extension Workers (92)	46.7	25.0	23.9	4.3
Journalists (44)	27.3	15.9	45.5	11.4
Policy Makers (97)	26.8	38.1	33.0	2.1
Scientists (37)	13.5	59.5	10.8	16.2

APPENDIX 2: TABLES USED ONLY IN DR. CASTILLO'S COMMENTARY

TABLE 2.1

**Stakeholders' Perception of Individuals' Groups' and Organizations' Concern about Public Health and Safety  
With regard to Agricultural Biotechnology**

	Consumers	Businessmen	Extension Workers	Farmer Leaders	Religious Workers	Journalists	Policy Makers	Scientists
	- Percent -							
1. University scientists								
Low	5	6	10	9	25	-	5	14
Moderate	20	13	12	19	16	4	16	3
High	75	74	65	51	50	89	74	65
Not sure	-	7	13	21	9	7	5	18
2. Private sector scientists								
Low	10	9	13	11	28	-	6	14
Moderate	28	17	17	17	21	20	20	5
High	60	65	55	61	38	68	66	62
Not sure	2	9	15	11	13	12	8	19
3. Agri-biotech companies								
Low	6	28	16	11	36	11	13	19
Moderate	18	6	13	23	7	2	13	11
High	72	61	58	61	48	73	64	43
Not sure	4	5	13	5	9	14	10	27
4. Consumer groups and NGOs								
Low	12	-	3	12	11	7	3	8
Moderate	33	7	20	23	23	11	20	3
High	54	80	69	61	53	73	74	70
Not sure	1	13	8	4	13	9	3	19
5. Local farm leaders								
Low	19	8	11	18	14	7	14	5
Moderate	32	22	33	19	34	11	29	22
High	49	54	50	58	38	75	53	49
Not sure	-	16	6	5	14	7	4	24
6. Mass Media								
Low	13	7	7	7	11	Not asked	9	8
Moderate	33	26	16	24	35		20	22
High	51	54	66	58	45		67	43
Not sure	3	13	11	11	9		4	27
7. General public								
Low	22	11	11	16	7	14	13	14
Moderate	33	13	21	26	16	20	26	16
High	40	63	61	44	68	61	57	54

Not sure	5	13	7	14	9	5	4	16
8. Religious groups								
Low	2	6	6	2	9	9	13	13
Moderate	8	9	4	17	25	9	8	14
High	90	76	84	72	62	68	73	49
Not sure	-	9	6	6	4	14	6	24
9. Research institutes								
Low	2	6	7	2	8	2	5	13
Moderate	8	9	4	17	25	2	11	13
High	89	76	84	72	63	89	78	48
Not sure	1	9	5	9	4	7	6	24

TABLE 2.2

**Stakeholders' Perceptions of Different Groups' and Organizations' Responsibility in Assessing and Managing the Risks and Benefits of Agricultural Biotechnology**

	Consumers	Businessmen	Extension Workers	Farmer Leaders	Religious Workers	Journalists	Policy Makers	Scientists
	- Percent -							
1. University scientists								
Low	2	5	1	3	9	-	1	-
Moderate	17	11	9	9	21	14	5	-
High	79	80	88	86	63	77	94	84
Not sure	2	4	2	2	7	9	-	16
2. Private sector scientists								
Low	4	6	4	4	7	-	1	3
Moderate	21	17	13	12	32	16	6	3
High	73	72	81	82	50	75	92	78
Not sure	2	5	2	2	11	9	1	16
3. Agri-biotech companies								
Low	1	2	3	4	9	2	-	3
Moderate	11	4	7	3	9	7	5	-
High	87	89	87	89	70	82	94	81
Not sure	1	5	3	4	12	9	1	16
4. Consumer groups and NGOs								
Low	8	8	4	9	16	-	10	8
Moderate	35	13	22	21	27	18	18	11
High	55	72	67	65	48	75	72	62
Not sure	2	7	7	5	9	7	-	19
5. Local farm leaders								
Low	14	6	10	23	13	-	12	8
Moderate	32	13	28	14	29	16	21	16
High	54	76	54	60	48	77	65	57

Not sure	-	5	8	3	11	7	2	19
6. Mass Media								
Low	11	15	6	16	7	Not asked	12	13
Moderate	28	9	20	28	29		10	13
High	60	69	72	56	53		73	51
Not sure	1	7	2	-	11		5	22
7. General public								
Low	14	9	6	10	20	-	12	14
Moderate	35	9	27	12	25	23	19	16
High	50	74	61	69	53	63	62	51
Not sure	1	8	6	9	2	14	7	19
8. Religious groups								
Low	24	17	12	19	9	11	17	24
Moderate	37	11	20	21	25	16	14	11
High	36	59	59	51	53	57	62	43
Not sure	3	13	9	9	13	16	7	22
9. Research institutes								
Low	1	4	2	2	5	2	-	-
Moderate	8	2	4	7	12	5	2	-
High	90	89	92	90	77	84	97	81
Not sure	1	5	2	1	6	9	1	19
10. Regulatory bodies								
Low	1	4	-	-	3	5	-	-
Moderate	6	2	10	3	11	4	1	-
High	93	89	90	88	82	82	97	84
Not sure	-	5	-	9	4	9	2	16

TABLE 2.3

3. Please read the following statements related what you know about biotechnology in food production. Circle your response under the heading *True, False, or Don't Know*.

	<i>True</i>	<i>False</i>	<i>Don't Know</i>
a. In reality, all crops have been “genetically modified” from their original state through domestication, selection, and controlled breeding over long periods.	1	2	3
b. Yeast for brewing beer consists of living organisms.	1	2	3
c. Ordinary tomatoes do not contain genes, while genetically modified tomatoes do.	1	2	3
d. With every new emerging technology, there will always be potential risks.	1	2	3
e. In genetic engineering, genes of interest are transferred from one organism to another.	1	2	3
f. Genetically modified rice contains beta-carotene.	1	2	3
g. More than half of human genes are identical to those of a monkey.	1	2	3
h. Science can guarantee zero-risk.	1	2	3
i. By eating genetically modified rice, a person’s genes could also be modified.	1	2	3
j. All radioactivity is man-made.	1	2	3
k. Genetically modified crops are now being commercially grown in Malaysia.	1	2	3
l. Genetically modified crops are now being commercially grown in other Asian countries.	1	2	3

TABLE 2.4

Sources of biotechnology information most frequently contacted within the past two months

	Stakeholder Groups							
	Consumers	Businessmen	Extension Workers	Farmer Leaders	Religious Workers	Journalists	Policy Makers	Scientists
	- Percent -							
1. Read about/watched biotech in TV, newspapers, and radio								
0 – 1 Low	56	50	56	51	53	32	44	35
2 Moderate	25	20	27	26	27	23	30	41
3 + High	19	30	17	23	20	45	26	24
2. Talked to or heard from family / friends / neighbors								
Low	75	56	52	67	77	43	50	57
Moderate	12	28	33	16	14	25	22	19
High	13	16	15	17	9	32	28	24

3. Talked to or heard from religious figure								
Low	95	89	84	81	80	79	82	94
Moderate	4	6	12	16	16	12	12	6
High	1	5	4	3	4	9	6	-
4. Talked to or heard from experts, colleagues, scientists								
Low	66	37	50	61	75	36	42	38
Moderate	16	22	29	28	16	30	24	27
High	18	41	21	11	9	34	34	35
5. Talked to or heard from NGOs								
Low	87	65	74	77	77	68	72	67
Moderate	9	20	18	19	14	23	18	22
High	4	15	8	4	9	9	10	11
6. Talked to or heard from local politician or leader								
Low	92	83	91	86	93	82	84	89
Moderate	6	11	8	11	5	14	9	8
High	2	6	1	3	2	4	7	3
7. Accessed a web-site on biotechnology								
Low	80	56	85	86	91	66	71	81
Moderate	10	20	10	7	9	18	7	11
High	10	24	5	7	-	16	22	8
8. Read books on biotech								
Low	89	70	68	79	80	59	59	73
Moderate	5	15	21	17	16	16	12	14
High	6	15	11	4	4	25	29	13
9. Read newsletters / pamphlets, brochures								
Low	73	48	52	72	80	48	46	57
Moderate	15	24	29	14	16	25	21	13
High	12	28	19	14	4	27	33	30
10. Talked to / heard from food regulators								
Low	90	70	73	87	91	66	72	84
Moderate	5	17	24	13	9	25	18	13
High	5	13	3	-	-	9	10	3
11. Attended seminars, public forums								
Low	91	70	78	84	96	61	63	68
Moderate	4	17	13	16	4	21	20	19
High	5	13	9	-	-	18	17	13
12. Talked to or heard from agri-biotech companies								
Low	86	68	75	84	91	61	69	84
Moderate	8	13	15	11	5	18	19	13
High	7	19	10	5	4	21	12	3

TABLE 2.5

Stakeholders' Patterns of Information Source Use (Ranks are based on the percent of Stakeholders using each source most frequently and are scored High or 3+) See Table –

	Stakeholder Groups							
	Consumers	Businessmen	Extension Workers	Farmer Leaders	Religious Workers	Journalists	Policy Makers	Scientists
	Rank of Source							
1. Read about/watched biotech in TV, newspapers, and radio	1	2	3	1	1	1	5	3
2. Talked to or heard from family / friends / neighbors	3	6	4	2	2	3	4	4
3. Talked to or heard from religious figure	12	12	10	10	5	11	11	12
4. Talked to or heard from experts, colleagues, scientists	2	1	1	4	4	2	1	1
5. Talked to or heard from NGOs	10	7	8	8	3	9	10	7
6. Talked to or heard from local politician or leader	11	11	12	9	9	12	12	9
7. Accessed a web-site on biotechnology	5	4	9	5	-	8	6	8
8. Read books on biotechnology	7	8	5	7	6	5	3	6
9. Read newsletters / pamphlets, brochures	4	3	2	3	7	4	2	2
10. Talked to / heard from food regulators	8	10	11	-	-	10	9	10
11. Attended seminars, public fora	9	9	7	-	-	7	7	5
12. Talked to or heard from agri-biotech companies	6	5	6	6	8	6	8	11