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ESA Working Paper No. 04-09

May 2004

Agricultural and Development Economics Division

The Food and Agriculture Organization
of the United Nations

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Abstract

The full benefits of agricultural biotechnology will only be realized if consumers and food manufacturers consider it safe and beneficial. Although few internationally comparable public opinion surveys have been conducted on this issue, the available evidence suggests that public attitudes differ sharply both between and within countries and are evolving over time. Consumer attitudes have been studied in the United States and Europe for more than a decade. This research is reviewed along with the available data from Latin America, Asia and Africa. Results from the largest internationally comparable public opinion survey on agricultural biotechnology to date are highlighted.

Key Words: Agricultural Biotechnology, Public Opinion, Consumer Acceptance.

JEL: D12, O13, Q18.

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Public Attitudes towards Agricultural Biotechnology

The full potential of biotechnology will only be realized if consumers and the food industry consider it safe and beneficial. While internationally comparable research on public attitudes towards agricultural biotechnology is limited, the available evidence suggests that attitudes differ widely between and within countries and are evolving over time. Most of the research on consumer attitudes to date has focused on the United States and Europe. We will review this research along with the available data from Asia. The results of the largest internationally comparable public opinion survey are highlighted. The paper concludes with reference to a survey of US food industry leaders.

Box: Public Opinion Research

Caution must be used in interpreting the results of public opinion research and, especially, in comparing results from different surveys, regions or time periods. Responses to public opinion studies are very sensitive to the conditions surrounding the surveys. The precise wording of the questions, the methods used to select respondents and administer the survey and the type of background information provided to respondents can influence the results substantially. For example, research has shown that the term “biotechnology” is much more accepted by the lay public than the term “genetically modified organism”. Although differences in terminology can cause the level “acceptance” to differ by 10-20 percent, many of the surveys reviewed here have used terms such as biotechnology, genetic engineering, genetic modification and GMO interchangeably, accounting for an unknown part of differences observed across countries and over time. Similarly, sample size and the methods used to select and administer the surveys can influence the results. Most of the surveys reviewed here involved approximately 1,000 interviews per country, representing a confidence level of just over 3 percent. The studies reviewed for the United States and Europe involved telephone surveys, while in developing countries, the interviews were generally conducted face-to-face. The public opinion studies surveyed here were performed by university professors, government agencies, industry groups and private polling firms. They include only some of the many studies conducted on the subject.

Global Trends in Public Perceptions of Biotechnology

The most extensive international study of consumer attitudes towards biotechnology was conducted by Environics International (2000). More than 35,000 respondents from 35 countries were asked whether they agreed that the benefits of biotechnology outweighed the risks.¹ Results for selected countries and regions are shown in Table 1 and Figure 1.

Some clear patterns are available in the response to this question. Over two-thirds of respondents in the following countries agreed that the benefits of GM crops are greater than the risks: United States, Colombia, Cuba, Dominican Republic, China, India, Indonesia, and Thailand. On the other hand, fewer than 40 percent of consumers in the following countries saw the benefits as greater than the risks: France, Greece, Italy, Spain, and Japan. Europe, Japan and South Korea

¹ The precise statement was: “The benefits of using biotechnology to create genetically modified food crops that do not require chemical pesticides are greater than the risk.”

are much more negative than other parts of the world. The US leads the industrialized countries in support for biotechnology. Overall, people in the developing countries tend to be quite supportive of GM crops.

There clearly are differences in public acceptance of different biotechnological products. Survey respondents were asked whether they would support or oppose the use of biotechnology to develop each of eight different applications of biotechnology (Figure 2.) Almost all respondents (85 percent) indicated that they would support the use of biotechnology to develop new human medicines. However, 15 percent would oppose the use of biotechnology even for such a clearly beneficial use. About three-quarters of people reported support for environmental clean-up and each of three different crop applications. Clearly, any mention of “animals” causes support to drop. Just over half (55 percent) expressed support for genetically modified animal feed (even when this resulted in healthier meat.) Only 42 percent supported the use of biotechnology to clone animals for medical research. In fact, almost three quarters of global consumers opposed the genetic modification of animals to increase productivity. These results suggest that the complex ethical and emotional issues associated with animal biotechnology have not been addressed sufficiently to overcome public concerns.

In another study entitled the “Food Issues Monitor,” Environics International (2001) asked consumers in ten countries whether they would buy food with GM ingredients if the resulting products were higher in nutrition (Figure 3). Respondents were given the option of continuing to buy the product or to stop buying it if they learned it was genetically modified. Consumers in China and India are clearly the most enthusiastic about these crops. There is also support among a majority of consumers from the US, Brazil, and Canada. On the other hand, a majority of European and Australia consumers would tend to reject GM foods even if they were more nutritious.

American Consumer Perceptions of Biotechnology

Public perceptions of biotechnology in the United States have been studied for over a decade. Because the process of technology adoption starts with awareness, consumers have been asked in various surveys: “How much have you heard or read about biotechnology—a lot, some, a little, or nothing?” (Hoban, 1996, 2001; IFIC, 2001.) Figure 4 charts the percentage of US consumers who reported having heard something or a lot about biotechnology. There are several notable trends in consumer awareness of biotechnology in the United States. For the first half of the 1990s, awareness remained rather low at about one-third. It hit a peak in 1997 when a survey was conducted soon after the news about Dolly, the cloned sheep. After that awareness dropped until May 2000, then began rising again, reaching a peak of 53 percent awareness in June 2001. Since then awareness has dropped again as other issues dominated the public agenda in the US.

This lack of awareness raises other questions about how well US consumers actually understand food biotechnology. Most Americans are not aware of the extent to which biotechnology has become part of their food supply. According to a survey conducted by the Pew Foundation for Agricultural Biotechnology, few consumers believed that GM foods are in wide use in the food supply, and even fewer believed that they have eaten them. Only 14 percent of consumers believed – correctly – that more than half of our food contains GM ingredients. Additionally, few Americans recognized that they had already eaten GM foods (Pew, 2001).

At the same time, consumers were uncertain about the safety of GM foods. When asked initially, with little background information, whether GM foods are safe, almost half of the respondents said that they did not know, 29 percent said they are basically safe, and 25 percent said they are basically unsafe. However, after being informed that more than half of the products at the grocery store contain GM ingredients, almost half said that GM foods are safe, only 21 percent said that they are unsafe, and 31 percent said they were unsure. In fact, one in five of those who initially said GM foods were unsafe, changed their minds. Thus, when some consumers learn how widespread GM foods are, they are more likely to believe they are safe. However, it is also true that some consumers become angry when they realize that they have not been told about the widespread presence of GM ingredients (Pew, 2001).

American consumer acceptance of biotechnology has been measured in a variety of ways in different surveys. Hoban repeated the same set of questions with two surveys in independent research (Hoban and Kendall, 1994), as well as in a survey conducted by Angus Reid, Inc. in 2000. The objective was to assess the level of consumer acceptance of three applications of biotechnology (Figure 5). In the case of insect-protected crops, acceptance was higher in 1992 (63 percent) and 1994 (67 percent) than in 2000 (51 percent). The same overall trend was noted for disease resistance in farm animals and for larger, faster-growing fish; but these applications were relatively less acceptable than plants at all points in time.

The most complex and contentious issue observed in US-based surveys involves whether foods developed through biotechnology should carry some type of label. On this particular subject, how questions are asked clearly has a major impact on how consumers respond. One neutral way is to simply ask, in an open-ended question, if respondents can think of any information not currently included that they would like to see on food labels. Surveys conducted between October 2000 (Hoban, 2000) and September 2002 (IFIC, 2002) found that only 2 percent of the people surveyed responded “genetically modified.” In both cases, three-quarters of the respondents said they could not think of any additional information they would like to see on food labels. This is noteworthy in that the interviews took place after the StarLink™ controversy became a public issue.

Consumers generally claim to want a wide variety of information on food labels about how foods and their ingredients are produced. The Center for Science in the Public Interest (CSPI) found about two-thirds of American consumers wanted foods containing genetically engineered ingredients to be labeled (CSPI, 2001). However, even more consumers (76 percent) wanted labeling for crops grown using pesticides. In fact, 40 percent of respondents said that they would like products containing hybrid corn to be labeled.

One way to measure consumers’ demand for labeling is to determine willingness to pay for that information. The CSPI survey found that 44 percent of consumers would pay “nothing” and another 17 percent would pay \$10 per year on top of their family’s current annual food bill for such labeling. Although as many as two-thirds of consumers may desire labeling of GM foods, few appear willing to pay the real costs for that information, which would result from the need for identity preservation, testing, certification, *etc.*

European Consumer Perceptions of Biotechnology

Eurobarometer surveys on biotechnology have been conducted in 1991, 1993, 1996, 1999 and 2002. The surveys are based on a representative sample of 16,500 respondents, approximately 1000 in each EU country. Survey design and analysis was conducted by a research group 'Life Sciences in European Society' supported by DG Research.

Results show public perceptions in the EU have fluctuated much more than in the United States. While trend data since 1991 shows little change in the high levels of consumer optimism for technologies like telecoms and computers, attitudes toward biotechnology have been more volatile. After continuously declining for almost a decade, optimism towards biotechnology increased during the period 1999-2002 to the level seen in the early 1990s. An index of optimism shows an appreciable change from the declining trend of the years 1991-1999. This rise in optimism holds for most EU countries, with the exception of Germany and the Netherlands, where such a rise was observed between 1996 and 1999. Clearly, some Europeans are still uncertain about the long-term impacts of biotechnology. One quarter said "Don't know" when asked whether it would improve their way of life or not, about the same percentage as in 1999. Among those who expressed an opinion, 44 percent of Europeans were optimistic and 17 percent pessimistic about biotechnology in general.

This research has also found clear differences on the acceptability of six applications of biotechnology. Europeans continue to distinguish between different types of applications that have been measured on each survey -- particularly medical applications compared to agri-food applications. Genetic testing for inherited diseases is seen as useful, morally acceptable and to be encouraged. The same holds for cloning human cells and tissues, even though this application is also seen as risky. These two applications are supported in all 15 EU countries.

However, it is clear that a majority of Europeans do not support GM foods (Figure 6). These are judged to not be useful and to be risky for society. Support for GM crops (Figure 7), is stronger than for GM foods. Such crops are judged to be moderately useful, but they are seen as almost as risky as GM foods. GM crops are clearly supported in Spain, Portugal, Ireland, Belgium, UK, Finland, Germany and the Netherlands, but not in France, Italy, Greece, Denmark, Austria and Luxembourg) have consumers that are most opposed to GM crops. Overall support for GM foods is seen in only four countries - Spain, Portugal, Ireland and Finland.

All EU countries, except Spain and Austria, showed moderate to large declines in support for GM crops over the period 1996-1999. Thereafter support more or less stabilized in France and Germany and increased in all the other countries with the exception of Italy, which saw a 10 percent decline in support. For GM food there is a rather similar pattern to GM crops. With the exception of Sweden and Austria all the European countries showed moderate to large declines in support over the years 1996-1999. Since 1999, the majority of countries showed an increase in support for GM foods with the exceptions of Germany and Finland where support was stable, and Italy, France and the Netherlands which experienced further declines.

Asian Consumer Perceptions of Biotechnology

The Asian Food Information Centre conducted interviews in 2002 with 600 consumers in China, Indonesia and the Philippines (AFIC, 2003). This research found the majority of consumers

were aware of the presence of biotechnology-derived foods in their everyday diets -- and there were not worried about this situation. A majority of consumer reported that they believed they had eaten genetically modified foods, took no action to avoid such products and were willing to try samples of genetically modified foods.

Survey respondents were asked about their food safety concerns. More than 90 percent of respondents reported personal concerns regarding nutrition and food safety. Those of greatest concern were nutritional value, microbial contamination and pesticide residues. GM foods were rated as the issue of least concern. In fact, respondents were positive about the broad range of potential benefits that biotechnology-derived foods may offer to consumers. Improved nutritional value and reduced cost appeared the most popular benefits, with 55 percent and 48 percent respectively of respondents indicating that they were very likely to buy such produce. Also, 66 percent of respondents reported that they expected either themselves or their families to benefit from food biotechnology during the next five years. These results are very consistent with similar studies done in the US over the past five years (IFIC 2002).

The mass media represent the main sources of information for consumers on all nutrition and food safety topics, including biotechnology. In fact, respondents indicated this was indeed their preferred source of this information. Public sector information sources, such as government agencies and scientists, were found to be much less popular as sources of information. Public sector bodies were, however, perceived as reliable and credible protectors of human health and safety.

Survey respondents expressed no demand for food labels to carry information on biotechnology or its presence in food products. The most common item checked for, on food labels was "expiration date." Following closely behind were "ingredients" and "nutritional value". Most consumers were satisfied with the information currently included on food labels, with a few exceptions, for items such as shelf life. Biotechnology was not named as an information item that consumers wish to see included in their food labels. Indeed the majority thought the amount of information currently included was about right.

As in many other countries, Asian consumers demonstrated little technical knowledge about biotechnology. However, consumers were found to have some awareness that biotechnology foods which have been approved as safe for human consumption are already widely available. Some also recognized which food crops had been modified through biotechnology. The majority of consumers found this acceptable. As is the case elsewhere, Asian consumers expressed some interest in learning more. They mainly wanted information about how this all relates to their own daily diet. They expressed little interest in information about the technology itself or the scientific principles on which it is based. For example, few consumers could explain the principles of microwave cooking or extended shelf life through pasteurization. However, many value the benefits these technologies provide in terms of choice, quality and safety of foods.

As discussed earlier, such case studies show how food technologies follow similar adoption patterns. Initial disinterest and some resistance is often evident from some interest groups. As the benefits to diet and health become apparent, consumer acceptance usually develops quite rapidly. Such case studies also indicate that technical knowledge is not a prerequisite of

consumer acceptance. However, clear communication of real (not hypothetical) risks and benefits in terms which relate to actual foods are an essential part of the adoption process.

Food Industry Leaders Perceptions of Biotechnology

The food industry plays a vital role in shaping consumers' attitudes and appetite for new food items. This is particularly true for the products developed with biotechnology. The world has become one global market both for raw commodities and for finished food products. Decisions made by food industry gatekeepers have an enormous impact on important stakeholders from the biotech labs to consumers' plates. There are numerous examples of how market forces have slowed or stopped development of promising new food crops. For example, varieties of "flavr-savr" bananas or disease resistant fruit for the tropics are slowed in the development and approval process because of concerns over EU rejection.

Telephone interviews were conducted with almost 250 key leaders from the U.S. food industry (Hoban 2001). The sample included representatives from across the food value chain, including suppliers, manufacturers, distributors, and food service operators. The respondents tended to include senior level staff with responsibilities in a number of functional areas (including public relations, consumer affairs, government relations, quality assurance or R&D). Some key findings are provided here. More information is available from the author upon request.

Most of the food industry leaders interviewed were enthusiastic about the benefits of biotechnology -- especially in terms of increased food availability, enhanced nutrition, and environmental protection. They expressed support for food and agricultural biotechnology. In fact, most respondents believe that biotechnology has already provided benefits to consumers. However, they do not feel that biotechnology has provided their companies with as much benefit as has been true for farmers. Food companies expect to benefit more in the future. That likely explains their continued support in the face of controversy.

Almost all recognized that foods developed through biotechnology are already part of consumers' everyday diet. They recognized that corn and soybeans have been modified through biotechnology for a number of years. The main concerns of the food industry involved lack of consumer acceptance -- not the safety of the foods. They expressed high levels of confidence in the science and the regulatory process. Almost no respondents felt that biotechnology should not be used because of uncertain, potential risks.

Most food industry leaders surveyed did not feel it is necessary to have special labels on foods developed through biotechnology. In fact, they expressed concerns that such labels would be perceived as a warning by consumers. They also recognized that the need to segregate commodities would pose financial and logistical burdens on everyone in the system — including consumers. They recognized the need for a realistic tolerance level or threshold for bioengineered ingredients.

Most of the food companies realized that only a small segment of consumers in the US are actually concerned about biotechnology. They agreed that the organic niche will be adequate to meet the needs of this group of concerned consumers. Food industry leaders recognized a major need to educate consumers about biotechnology. They look to third parties, such as university and government scientists to provide such leadership.

At the time of the survey (2000), food industry representatives were optimistic about the future for plant biotechnology. Most did expect that consumers will buy food as soon as they recognize relevant benefits (especially enhanced nutrition, reduced pesticides, and lower prices). However, recent controversies over pharmaceutical plants have significantly raised the level of food industry awareness and concern over plant biotechnology issues.

Conclusions

Consumer attitudes towards biotechnology differ across and within countries. Comparisons of results from different studies must be made with caution, because of the sensitivity of such studies to the particular circumstances surrounding their design and administration. The detailed studies for the United States, Europe and Asia reviewed above generally confirm the results of the Environics International studies, the only internationally comparable studies available to date. In general, consumers in the United States and Asia are more favourably disposed towards biotechnology than Europeans, although significant minorities in most countries express reservations. Trends in the United States and Europe have fluctuated over time, with European views growing generally more negative throughout the 1990s before turning slightly more positive in the most recent survey. How these trends will evolve in the future is a matter for continuing research.

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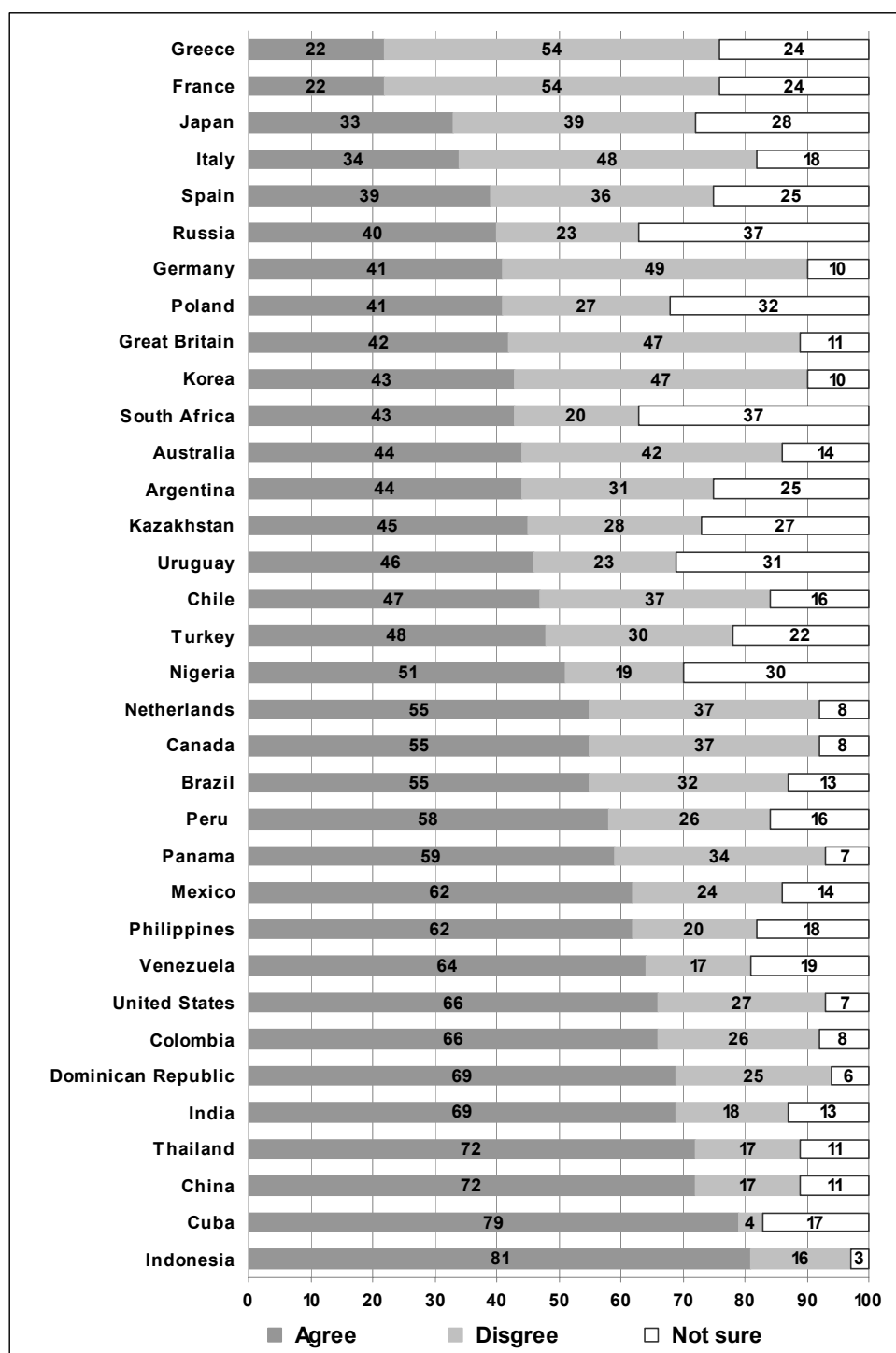
Table 1: Benefits of biotechnology outweigh the risks

	Agree (percent)	Disagree (percent)
The Americas		
United States	66	27
Canada	55	37
Mexico	62	24
Argentina	44	31
Brazil	55	32
Chile	47	37
Colombia	66	26
Cuba	79	4
Dominican Republic	69	25
Panama	59	34
Peru	58	26
Uruguay	46	23
Venezuela	64	17
Europe		
France	22	54
Germany	41	49
Great Britain	42	47
Greece	22	54
Italy	34	48
Netherlands	55	37
Poland	41	27
Spain	39	36
Asia and the Pacific Rim		
Australia	44	42
China	72	17
India	69	18
Indonesia	81	16
Japan	33	39
Korea	43	47
Philippines	62	20
Thailand	72	17
Africa		
Nigeria	51	19
South Africa	43	20

(Source: Environics International, 2000)

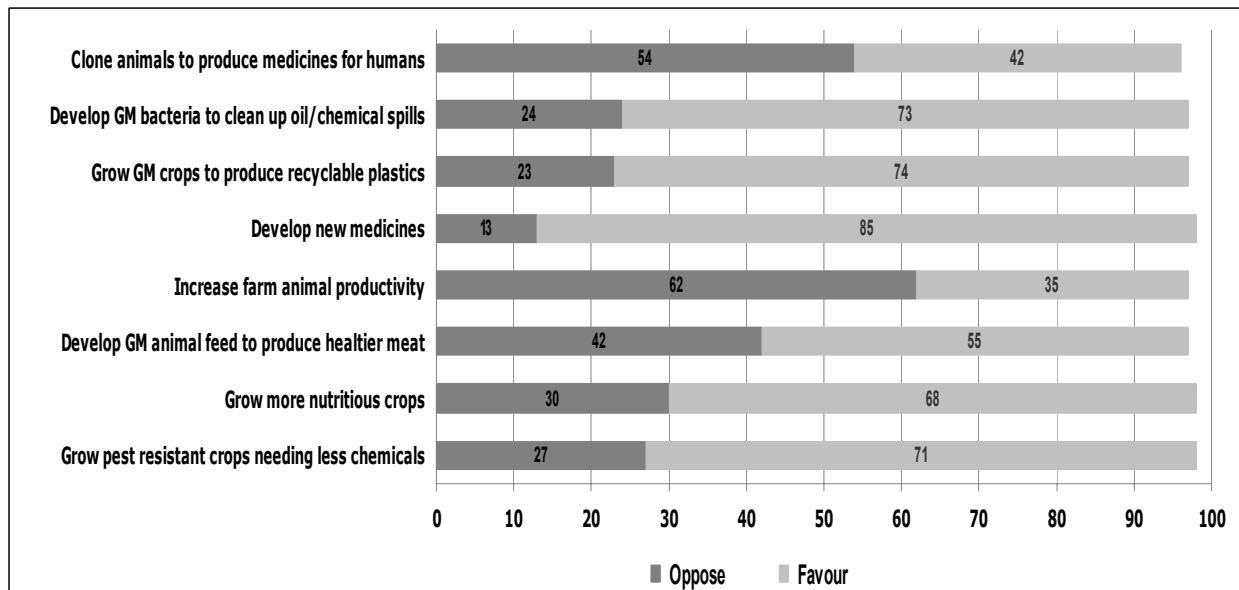
Note: Percentages who agreed or disagreed do not equal 100 percent because varying percentage of respondents had “no opinion” or were neutral.

Figure 1: The benefits of biotechnology outweigh the risks



Source: Environics International (2000)

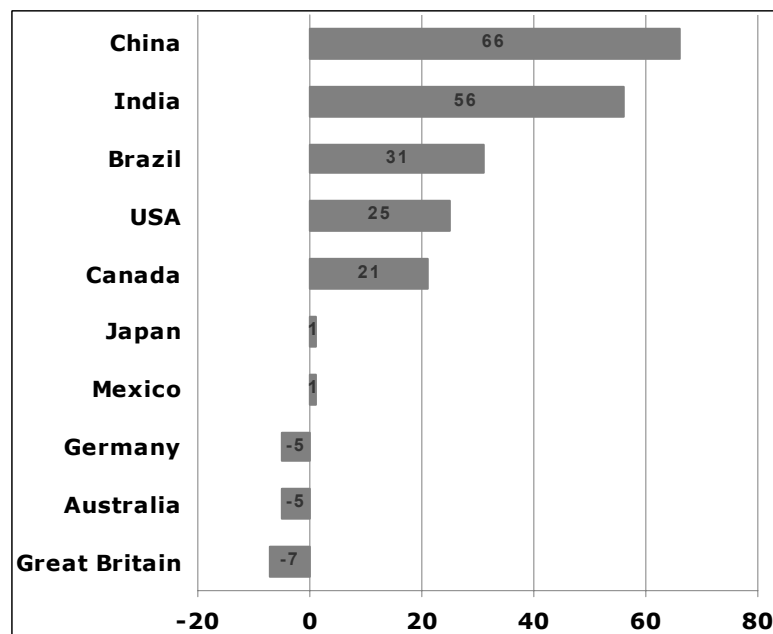
Figure 2: Do you support these biotechnology applications?



Source: Environics International (2000)

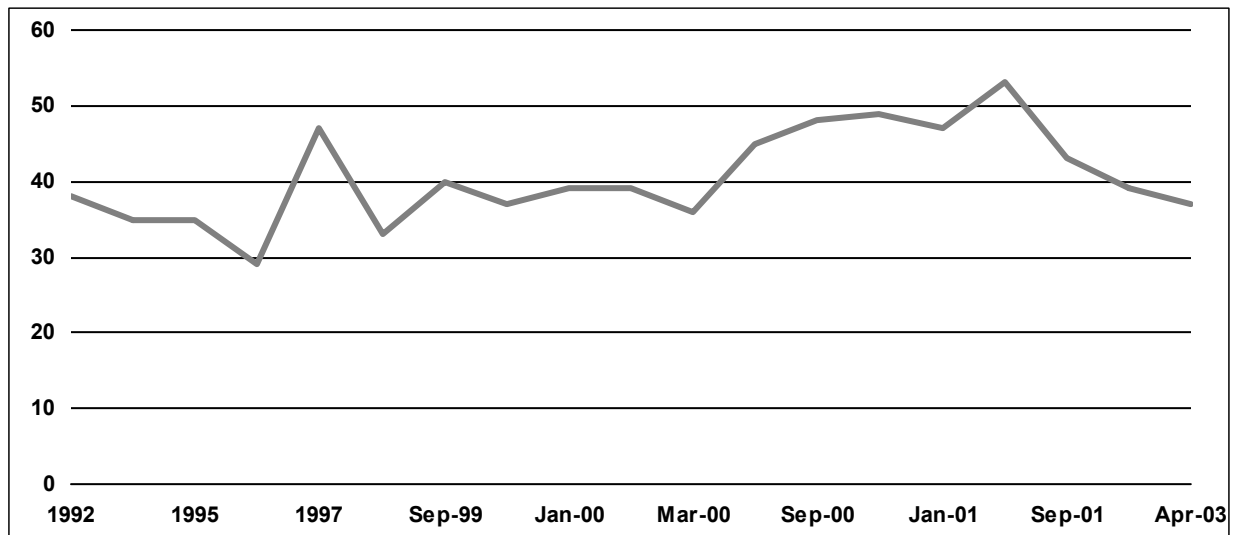
Figure 3: Would you buy nutritionally enhanced GM foods?

(Net = Continue – Not continue)



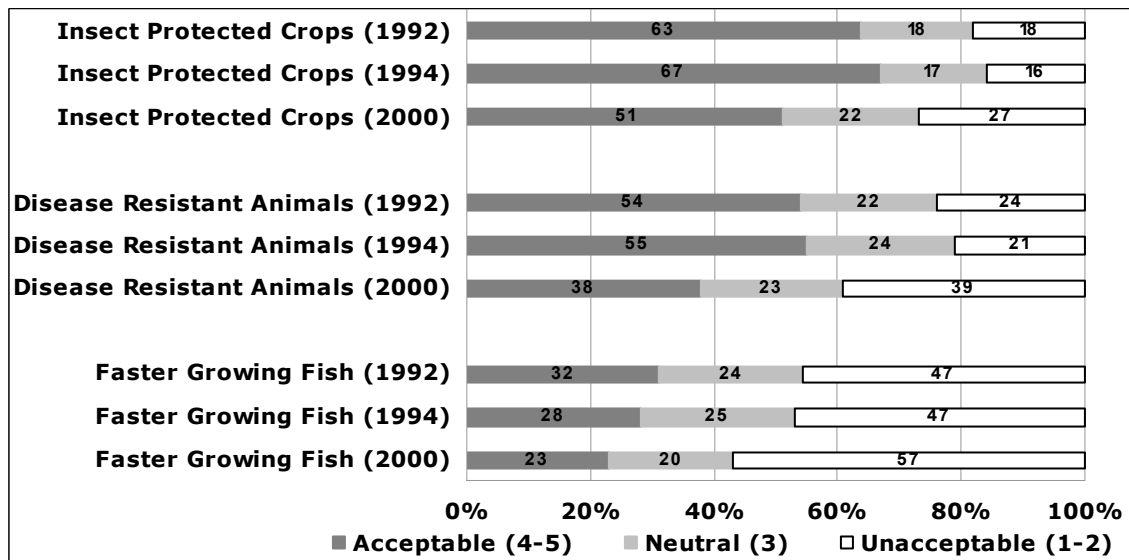
Source: Environics International, 2001.

Figure 4: Share of US consumers who have heard or read “some” or “a lot” about biotechnology



Sources: Hoban, 1996, 2001; IFIC, 2001

Figure 5: Trends in US acceptance of biotechnology applications



Sources: Hoban and Kendall, 1994; Angus Reid, Inc., 2000.

Figure 6: Trends in European support for GM foods

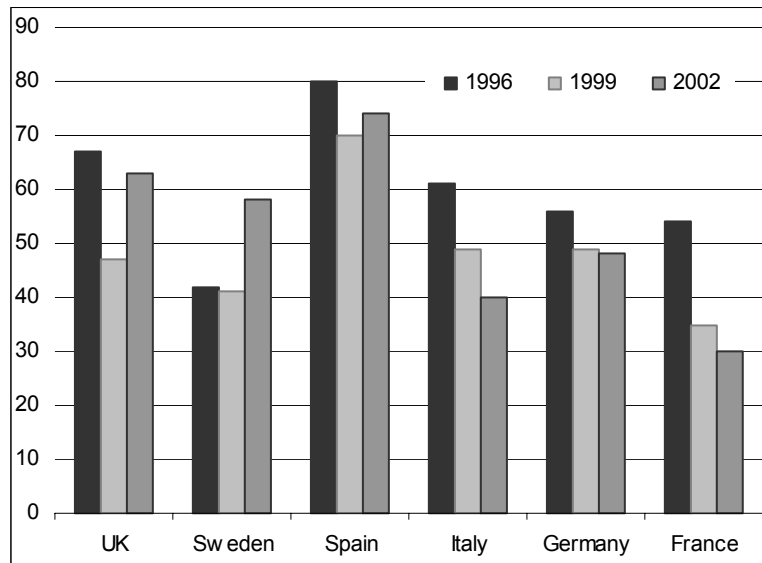
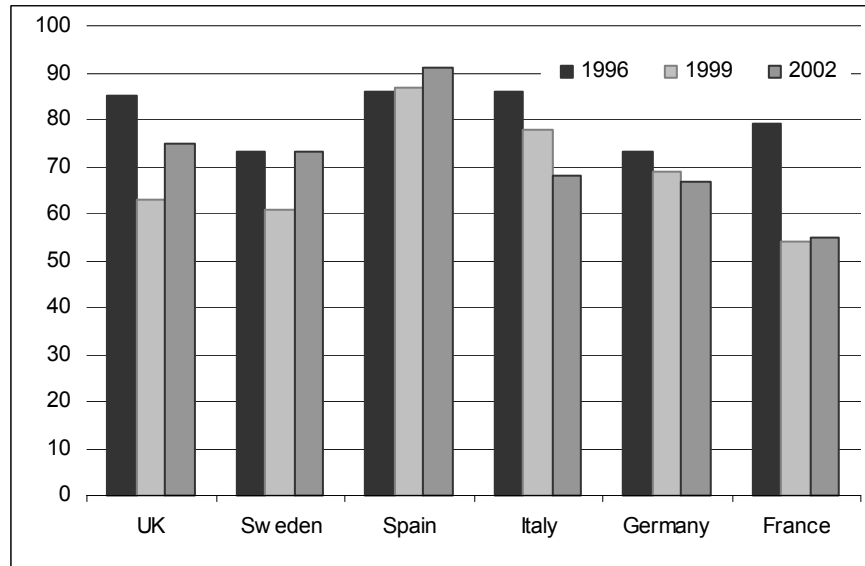


Figure 7: Trends in European support for GM crops



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