

# Public Perception of Biotechnology and Genetic Engineering in Spain: Tendencies and Ambivalence

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**ABSTRACT** The authors analyse available data concerning the public perception of biotechnology and genetic engineering in Spain. The data show a series of ambivalent attitudes in Spanish public opinion towards these modern technologies. Although research in human genetic engineering is considered to be valuable, its application is questioned from an ethical perspective. Biotechnology is believed to be useful to humanity, yet Spaniards are not in favour of its application to food production. Another aspect of Spanish public opinion is the poor knowledge of the technologies at issue. The authors argue that this situation is caused primarily by the lack of debate in Spanish society concerning the social, legal, ethical, and economic implications of biotechnology and genetic engineering. The absence of public debate on technology in a particular society is a reflection and a cause of that society's failure to engage in the processes of conflict, negotiation, and regulation that lead to the configuration of the technology.

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## Introduction

Whenever a question concerning the relationship between biotechnology and society is raised, it is necessary to consider the profound changes that have occurred in the last 30 years in the public's understanding and representation of technology. It was during this period of time that technology became an object of sociological analysis, as well as an object of public scrutiny and political debate. It has been pointed out on numerous occasions that around 1960, a series of social movements focused attention on technological developments. The reasons for this are diverse: Major technological accidents occurred and became objects of media interest, trust in experts and public administrations waned, and issues relating to protection of public health and the physical environment became politicized. Also, "big science" appeared, scientific and technological mega-projects were developed, and academia became concerned with bringing back science and technology on the one hand and the social sciences and humanities on the other. In addition, counter-cultural movements that challenged technological development appeared.

In order to understand the peculiarities of the development of biotechnology and genetic engineering, one should note that this development occurs precisely in the new socio-political context involving technology. One should also note the specific features of these technologies: their ability to affect almost all economic sectors, their symbolic dimensions that affect our understanding of biological processes and of ourselves as living organisms, and their relation with some of the most debated issues of our times, such as biodiversity, the transference of technologies, North-South relations, and property rights.

All of these factors combine to make biotechnology a unique case of technology development. Scholars and researchers have begun to analyse the social dimensions of biotechnology. Moreover, administrations and institutions have shown an interest in the public's opinions and attitudes towards the development of this technology.

This concern about public opinion has manifested itself in a number of sociological studies. Among them, those carried out by the Office of Technology Assessment (OTA) in the United States in 1987 and the Eurobarometer 35.1 study should be noted. With state and EC funding, studies of this kind have been carried out in Denmark (1) Ireland (2) the Netherlands (3) and the United Kingdom (4) and for the whole of the European Community.(5) There have also been a number of qualitative studies that included workshops and discussion groups in Germany, Spain, France, and the United Kingdom.(6)

The Instituto de Estudios Sociales Avanzados (IESA) has conducted a survey on the Spanish public's perception of and attitudes towards biotechnology.(7) In addition, the Eurobarometer 35.1 survey includes data on public attitudes towards biotechnology and genetic engineering,(8) and Centro de Investigaciones sobre la Realidad Social (CIRES) conducted a survey that includes data on the social attitudes towards science and technology.(9) Following the general orientation of the studies on public perception of biotechnology carried out in different countries, the IESA carried out its own research in 1990 to determine the attitudes of Spaniards towards biotechnology. In this sociological study, three complementary techniques were used: a telephone survey of 1,127 individuals more than 18 years of age who were residing in Spain's major cities; two discussion groups - one composed of men and the other of women - the participants of which had university degrees or the equivalent, professional experience, and were not active in any political organization or party; and two workshops that included representatives of institutions and organizations that in some way dealt with biotechnology. The questionnaire used for the telephone surveys contains 12 questions the answers to which are expressed either in a yes-no form or by explicit options. The questions dealt with five central topics: public information on biotechnology; an estimate on the impact of biotechnology on quality of life; the perception of the risk-benefit ratio; ethical problems related to biotechnology and genetic engineering; and the control and regulation of biotechnological applications.(10) The Eurobarometer 35.1 survey on biotechnology and genetic engineering was carried out between March and April of 1991. In the whole of the European Community, 12,800 people were interviewed, including 1,000 in Spain.(11) The CIRES data relating to social attitudes towards science and technology were gathered in February 1992. The sample number in this survey is 1,200.

#### Information and Knowledge

In the section of the IESA questionnaire concerning knowledge and information, the objective was to determine the extent of public awareness of biotechnology. According to the responses, awareness decreases with age: the younger respondents were the most familiar

with biological and biotechnological terminology. These responses also varied according to the occupation and education levels of the respondents (Table 1). The difference between the degree of familiarity with basic biological concepts such as chromosome or gene or concepts that are more specific to biotechnology and genetic engineering, such as clone, is notable. It is not insignificant that the best known concept in this part of the survey was that of in-vitro fertilization. This concept is, without doubt, the biotechnological issue that has attracted the most attention in the Spanish media. It has also, as a result of legislative developments, become the object of public debate.

These results can be analyzed further using the data that appear in Table 2, which show that the respondents conceptualized biotechnology in a very generalized way. Most of the individuals in the sample associated biotechnology with advanced techniques, new technology, and life sciences. One of the most significant results is the large number of responses in the "Don't know/No answer" category (49.4%). Although surprising, these data are very similar to those found by Eurobarometer, which show clear differences in the degrees of knowledge of the respondents of different European countries. The number of "Don't know" responses in the less developed countries of the European Community is significantly high. In general, the data are consistent with these scores obtained from the responses to the questions that determine the degree of knowledge about biotechnology and genetic engineering (Table 3). The Eurobarometer questionnaire contained seven items designed to evaluate familiarity with or degree of knowledge of biotechnology and genetic engineering. The respondents were asked whether certain activities were biotechnological practices or cases of genetic engineering (e.g., the production of new kinds of organisms using genetic information from other species). In the seven cases, the correct response was "yes." The results appear in Table 3. From the results of both the IESA and Eurobarometer studies, we conclude that the Spanish public possesses a substantially lower level of information on developments in biotechnology and genetic engineering than does the public in the more developed countries of the European Community. From the IESA study, it can be inferred that Spaniards who know something about biotechnology can be characterized as individuals between 18 and 45 years of age with a middle or high level of education. To analyse sources of information, the data made available by Eurobarometer and by CIRES are used. According to the data in Table 4, most of the respondents do not spend any time learning about science and technology in any specific medium. But approximately half of those interviewed (47.9%) admit to reading about science and technology in general-interest newspapers and journals. Furthermore, according to the Eurobarometer data (Table 5), in Spain, the principal sources of information on technological development are newspapers and television. From these results, it can be concluded that Spaniards do not keep up to date with developments in science and technology as a matter of course, and that the information to which they have access is drawn mainly from newspapers and television.

### **Biotechnology and Quality of Life**

Spaniards favour science and technology in general. In fact, according to the Eurobarometer data, Spain has the highest degree of optimism regarding technological development. 12 According to the data from the CIRES survey, 69.2% of the Spanish public thinks that science and technology will be a benefit rather than a detriment to humanity, whereas 17.5% believe that the opposite is true (Table 6). The degree of technological optimism correlates positively with the level of education.

This favourable attitude of Spaniards towards science and technology is also evident when specific technologies are concerned (Table 7). In the data supplied by Eurobarometer, the following points should be noted: Biotechnology and genetic engineering are clearly regarded with a measure of approval, although less so than technologies like telecommunications or computers; attitudes towards biotechnology are more positive than those towards genetic engineering; the highest percentages of "Don't know/No answer" are found in response to questions concerning biotechnology (35%) and genetic engineering (34%); and the low level of awareness in Spain of biotechnology and genetic engineering is emphasized.

The results of the IESA survey show that the public supports technologies for robotics and synthetic food development less than those for genetic engineering, solar power, and organ transplants. This tendency is especially notable among women. In any case, the degree of approval of technological applications correlates with the level of formal education of the respondents.

The results of one of the questions deliberately formulated to analyse more accurately the public's opinion on the impact of genetic engineering indicate that the people who were interviewed believe that, among the proposed issues, the environment will most likely suffer the greatest impact (34.5%). As far as the other issues are concerned, 27.2% believe that the development of genetic engineering can have a negative effect on social harmony, 26.4% believe this for the quality of life, 20.1% for the solution to the problem of world hunger, 26.9% for equality among people of the world, and 31.7% for the creation of employment.

These results show that even when more specific questions are asked, about a quarter of those interviewed see the development of biotechnology and genetic engineering as a threat. Again, the youngest and the most highly educated individuals tend to display a greater optimism regarding the possible impact of biotechnology and genetic engineering.

### **Public Perception of Risks and Benefits**

As we have pointed out before, men are much more optimistic than women, the young are more optimistic than the more mature, the more educated are more optimistic than the less educated, and the nonpracticing Catholics and agnostics are more optimistic than the practicing believers about the development of biotechnology. According to the positive attitude of those interviewed, biotechnology is considered by the majority to carry few or no risks (Table 8). However, this attitude manifests itself differently when specific biotechnological practices are considered.

Biotechnology and genetic engineering are technologies of a horizontal nature that have social and economic repercussions in a large number of sectors: medicine, agriculture, the protection of the environment, mining, and the chemical and pharmaceutical industries. Furthermore, biotechnology and genetic engineering, being both human and nonhuman life related technologies, possess considerable symbolic and cultural consequences. In other words, they affect our conception of biological phenomena and of ourselves as living beings while influencing our conception of nature and our relation to it. (13) For this reason, it is necessary, as far as it is possible, to determine the perception of risks involved or the level of ethical acceptance in relation to defined spheres of application. In the IESA study, the respondents' appreciation and evaluation of the risks and benefits associated with the development of biotechnology were evaluated with a series of questions related to specific applications of genetic engineering, including the technological products resulting from this activity.

According to the data listed in Table 9, the applications of genetic engineering in the field of medicine (i.e., diagnosis and therapy) received the highest level of approval. Men were more favourably disposed than women towards applications in other economic sectors. Women reacted negatively to the two sections concerning animal products produced for human alimentary consumption: the raising of large fish and quick-fattening livestock.

Having reached this point, we believe it is possible to establish an important conclusion: The respondents express a more favourable attitude when they are questioned in general terms about biotechnology and genetic engineering and a less favourable attitude - or, at least, a more carefully held one - when the questions involve specific applications. As is shown in the next section, something similar occurs if questions concerning ethical acceptability of certain practices are posed.

### **Biotechnology and Ethics**

Those interviewed were asked about their opinions regarding the acceptability, from an ethical perspective, of the applications of genetic engineering in certain areas. As from the rest of the responses, it can be seen that there is a more or less favourable disposition among the respondents towards the applications of recombinant DNA technology. But this support is clearly inferior to that exhibited when more generic questions concerning biotechnology or genetic engineering were posed.

Focusing on the whole of the proposed activities, the degree of approval can be expressed in the following descending-order sequence: plants, bacteria, animals, human somatic cells, and human embryos. This same sequence is reflected unequivocally in the research carried out by the OTA in the United States.<sup>14</sup> As for other tendencies, there is a reaffirmation of those discussed previously. For the whole of the proposed group of genetic engineering practices, approval gradually increases with the level of the education of the interviewees. In general, women were more reticent than men towards the practical application of genetic engineering, and the young were more favourably disposed towards it than older individuals. Active Catholics were the most reluctant to accept these practices, especially in the case of human embryos.

### **Science and Technology Policy**

An issue that has attracted considerable interest in recent times is the management of science and technology. For years it was thought that the public should limit funding to pure science. Following this academic activity, market forces entered whenever ways of applying theoretical knowledge to the generation of socially beneficial technologies were found. Around the mid 1960s, this model of the science-technology-society relationship was clearly in crisis. Certain social movements in the more developed countries began to demand some sort of public management of the science and technology system. Moreover, it became clear in recent decades that simply supporting pure science does not automatically lead to socially beneficial technologies, if to any technologies at all. At present, the view that science and technology systems, given their economic importance and the magnitude of the social impact of their products, should be managed in a way that is both efficient and democratic has gained ground.

In the IESA study, the question of who should control scientific and technological development was raised. The results appear in Table 10. The largest degree of distrust was towards the economic interests tied to the development of any particular technological sector. Scientists compose the group that is most trusted to manage science and technology by those

interviewed. They are followed by international organizations and administrations. It should be noted that the data that relate to ethics committees, in contrast to those from neighbouring countries, show them to be a rare kind of organization in Spain.

The data is complemented by data from the Eurobarometer and CIRES surveys. There are two features that deserve to be mentioned: Although Spaniards show much confidence in scientists, they clearly see the need for some kind of external control; and Spaniards trust scientists in general and not only to control science and technology.

Of those interviewed by CIRES, 86.7% consider it appropriate that some sort of international organization should exercise control over scientific activities. In the Eurobarometer study, a question was asked concerning the necessity of government control over genetic engineering and biotechnological research. The results correspond to those that show a greater degree of homogeneity throughout the European Community. In a scale that runs from +2 (the maximum possible agreement with the government control requirement) to -2 (the maximum possible disagreement with the requirement), the Netherlands favoured the greatest degree of control (+1.74), and Luxembourg the least (+1.34). The Spanish index is +1.44.(15)

Doctors, scientists, and university teachers comprise the social groups most trusted by the respondents. It could be said that, in general, the Spanish public has a positive attitude towards science and technology as well as a certain respect for scientists and their work (Table 11).

The questionnaire used by CIRES contained questions concerning one's level of agreement with six statements about science and technology. One of these was the following: 'We cannot be sure that the decisions of scientists are always the right ones.' Fourteen percent of interviewees said they "strongly agreed with this statement, and 43% "agreed." Thus, we cannot say that the Spanish public's trust in scientific work can be interpreted as blind faith.

The survey considered the limits of scientific and technological research and application, including the ethical limitations in the case of genetic engineering. Regarding limitations imposed as results of threats to the environment, we have specific data for science and technology in general, but not for biotechnology and genetic engineering specifically. Of those interviewed by CIRES, 89% believe that the conservation of the environment is a main priority, even if it means a slowdown in the progress of science and technology. Only 6% think the contrary.

In a large number of countries of the European Community there have been experimental attempts to establish certain kinds of organizations to assess and manage biotechnological and genetic engineering practices. The dissemination of genetically modified organisms, the applications of recombinant DNA technology to human beings, or the conditions of work in biotechnological laboratories are examples of activities for which bodies such as ethics committees or bio-security councils have been created. In this context, the problem that arises concerns who should or can constitute these bodies. In this regard, we have no data on the Spanish public's opinion, although the response to one of the questions for Eurobarometer helps us to get an idea (Table 12). The groups with the highest credibility are consumer organizations and environmentalist associations. From the responses to these Eurobarometer questions, it can be gleaned that the interviewees were not prepared to trust the interests of the biotechnology and genetic engineering industries. In the IESA study, the respondents were not keen to allow economic interests to play a major role in the management of science and technology. These appear to be complementary data.

## **Tendencies and Ambivalence**

In this section, the tendencies that the data present are identified, bearing in mind that in many cases what they show is ambivalence. At this point, it would be convenient to define the background upon which both the tendencies and the ambivalence are manifest. The Spanish public possesses, in general terms, a favourable view of science, technology, and the individuals involved in the development of these activities. This image of technology spills over into the case of biotechnology and genetic engineering: Spaniards are favourably disposed towards both. According to the Eurobarometer data, the Spanish public is one of the most positively disposed towards these technologies. In a comparative analysis of the public representation of science, the data on Spain show that scientific work is generally considered an important factor in the improvement of the condition of life for humankind as a whole (16)

This aspect of Spanish public opinion should be adjusted to reflect social and demographic variables. Men have a more positive view than women, younger individuals are more positive than older ones, those with more education are more positive than those with less education, and those without religious beliefs are more positive than those with religious beliefs. This is the general background upon which the tendencies and ambivalence should be examined.

As was already pointed out, the respondents were not too familiar with biotechnology and genetic engineering. Those with a higher level of formal education held a more positive attitude towards these technologies. The interpretation of this tendency appears to be clear: greater familiarity implies greater approval. It is necessary, however, to make some further remarks. Those who belong to environmentalist groups or who are active in organizations critical of the development of biotechnology and genetic engineering, both in Spain and in other countries, are individuals with a level of education that is clearly higher than the public average.(17)

The opinions and attitudes of those interviewed differ significantly according to the type of question posed: biotechnology and genetic engineering in general vs specific sectors, and research vs application. This result corresponds to those found by other studies,(18) and conflicts with the results of surveys that take scientific research into account with practically no reference to technological application. (19)

According to the Eurobarometer survey, Spaniards support, in a number greater than the European Community's average, research in the field of human genetic engineering. However, 48.9% of those interviewed for the IESA study consider the application of genetic engineering to human somatic cells to be unacceptable from an ethical point of view. This level of intolerance reaches 63.8% in the case of the application of these technologies to human embryos.

The general picture of support for human genetic engineering becomes progressively complicated as the variety of responses to different questions on the issue are taken into account. Spaniards clearly favour research, while questioning its application from an ethical point of view.

But an even more complex picture of the perceptions and attitudes of Spaniards can be drawn in the case of human genetic engineering. From an ethical point of view, this practice is considered questionable; yet, 66.6% agree that genetic engineering should produce new genetic therapies, and 96.2% agree that it should be employed in the prevention of hereditary diseases (Table 9).

This difference of attitude towards research and technological products reappears when the issue of the application of genetic engineering to alimentary products is raised. The scale of ethical approval of the applications of genetic engineering is the following: plants, bacteria, animals, human somatic cells, and finally, human embryos. Now, the introduction of food products gives rise to a significant change of attitude. Those who do not agree that genetic engineering should produce faster-fattening livestock compose 76.1% of all respondents, and 72.1% are against the artificial creation of bigger fish for consumption (Table 9).

The factors that determine these attitudes are varied. It is known that the traditional Spanish culinary culture does not easily accept industrially treated foodstuffs. In fact, this study shows that 64% of those interviewed do not believe that synthetic foods help improve the quality of life.

The dramatic episodes of alimentary adulteration in Spain should also be taken into account. The massive poisoning caused by the ingestion of nonedible rapeseed oil and the fraudulent use of hormones for the fattening of livestock may have helped create a certain degree of mistrust towards institutional control of the quality and healthfulness of foodstuffs. In any case, it is clear that the respondents are not favourably disposed towards the consumption of food products developed through genetic engineering.

It has been known now for a while that experts in science and technology policy and in the social study of science and technology do not agree with the "linear model": Basic research implies technological development implies social well-being. The results presented here refer to ethical evaluation and the attitude towards consumption in the case of biotechnology and human genetic engineering, and show that public opinion does not take for granted the supposed validity of the linear model either.

Another point worth mentioning is the difference in the approval of the application of genetic engineering with diagnostic or therapeutic aims. Spaniards are in favour more of gene-centred diagnosis than of gene-centred therapy. It should be noted that diagnosis without therapy is a controversial issue. Furthermore, genetic diagnoses could be used in areas in which great social tensions are generated, and could lead to discrimination in the workplace and in insurance policies. It is clear, therefore, that the debate on the applications of genetic diagnosis has not quite taken root among the Spanish public.

Regarding the management of science and technology, a certain ambivalence in Spanish public opinion is observed. Spaniards lend a high degree of credibility and trust to scientists. But it cannot be ignored that there is clear support for organizations that manage technological development. Of all respondents, 61.3% believed that scientists should play the major role in controlling scientific and technological enterprises. If the responses that reflect support of control by international organizations, public administrations, or ethics committees are grouped together, a figure of 75.7% is reached. We believe, therefore, that these data show a high degree of confidence in scientists, as well as a public demand for the establishment of mechanisms for the management of technological development. This last consideration is backed up, in the case of biotechnology and genetic engineering, by the demand for government control, as shown by the Eurobarometer data.

## Conclusion

Returning to the question of familiarity that the Spanish public exhibits with biotechnology and genetic engineering, Spanish citizens possess little knowledge of the different social, economic,



and moral aspects of biotechnology. We know that the circumstances that could have brought about this situation are numerous. The generally low level of education in a large proportion of the Spanish population is an example. Without wishing to diminish the significance of this factor, we believe that other ones should be kept in mind. In Spain, in contrast to what has happened in most other European countries, there has been practically no social debate about research in and the different applications of biotechnology. This may turn out to be a problem.

It is considered throughout the European Community that biotechnology is an issue of great importance, both for its economic potential and for its possible social and environmental implications. As a consequence of this concern and of the development of biotechnology, the European Commission has passed a series of directives on biosecurity. Directive 219190 regulates the use of genetically modified microorganisms in confinement, such as R&D or industrial laboratories, and Directive 220/91 urges member states to lay down regulatory measures for the dissemination of genetically modified organisms. Other directives concern the protection of workers. Currently there is a proposal for a directive relating to patents.

The questions that have concerned the European Community have been publicly analyzed, discussed, and debated in the majority of European countries. For these societies, European Community's legislation is related, in some sense or other, with public debate. But this is not the case in Spain. Spanish society may find that some norms refer to matters about which it possesses little information and about which there has been no debate or exchange of views. This is a worrisome situation that could, in time, generate problems. It seems that institutions should aim to create greater awareness among the Spanish citizens of the important issues related to biotechnology and genetic engineering.

A large proportion of the concerns currently being examined in the social study of technology involves the conception of technological development as a process of conflict and negotiation between different social groups with different interests. <sup>20</sup> In a world like ours, these processes are not limited to areas defined by administrative frontiers, but have an international dimension. The absence in a particular society of public debate on one technology or other can be seen as a reflection and as a cause of its failure to engage in the processes of conflict, negotiation, and regulation that lead to the configuration of this technology.

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