
Biotech and Food Safety in China: Consumers' Acceptance or Resistance?

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ABSTRACT

Although China is one of the world's largest producers and consumers of genetically modified (GM) crops and derived food products, little is known about the level of Chinese consumer awareness, understanding and acceptance of GM food. Initially, China pursued relatively aggressive policies for biotechnology development, but in recent years, the central government has become more sensitive to the potential environmental risks of transgenic food crops. To protect domestic biotech industries, the state plays a critical role in the politics of biotechnology, and does not allow GM food to become a prominent public issue. This contribution reports on a survey of 1,000 urban respondents. It demonstrates that most consumers lack the most basic understanding of biotechnology and its potential risks. The majority of the respondents (60 per cent) were either unwilling to consume GM food or neutral about the idea, but when given neutrally-worded information about potential GM food allergenicity, the willingness to buy dropped sharply. This might point to future scenarios of consumer resistance against GM food as has happened in European Union member states. This effect demonstrates the malleability of the Chinese consumer in a context of limited understanding and inadequate access to information.

INTRODUCTION

In most countries, levels of awareness and acceptance of genetically modified (GM) food have been shaped by divergent messages from environmentalists and biotech industries. Empirical evidence from biological studies is interpreted in such different ways that opinions are unlikely to converge in the near future (see for example, Royal Society of London, 2003). In the debates about the pros and cons of GM food we find, on one side, concerned biologists, organic farmers and environmental non-governmental organizations (NGOs) who have linked up with consumer organizations. They are pitted against agricultural specialists and biotech industry

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representatives who highlight the benefits of GM crops and food to farmers and consumers (Wansink and Kim, 2002). Over the years, an overwhelming number of empirical studies have been conducted on the public awareness and acceptance of GM food products in various countries.¹ Although China is one of the largest producers and consumers of GM crops and food, there has been relatively little reporting about Chinese consumers' awareness and acceptance in the international literature.

Initially, China embarked on an aggressive and expansionist strategy to develop its biotech sector. However, in recent years, the Chinese government has become more cautious about food safety and the potential environmental risks of transgenic crops, and is now attempting to keep all options open. In practice, this means an arduous balancing act of trying to protect the domestic biotech sector from foreign competition, while preventing an uncontrolled spread of GM material into the food chain and the environment through specific biosafety regulations, such as zoning, biosafety application procedures, and the labelling of GM food. However, the results from these efforts are highly mixed: 'GM-free zones' such as Xinjiang illegally cultivate Bt cotton, understaffed state institutions fail to control the seed market, and 'experimental' GM rice is clandestinely grown and sold on local markets. Moreover, in contrast to the European Union (EU) where environmental NGOs and consumer organizations have influenced public debates and discussions in the media, Chinese civic groups are weak and the central state does not allow genetic modification to become a widely debated public issue. This is the backdrop against which this contribution has been written.

In September 2003, two months after the Beijing government had implemented regulations on labelling genetically modified soybean oil, we conducted a survey of consumer awareness and acceptance of GM food products in four supermarkets in different districts (three in Beijing and one in Shijiazhuang city in Hebei province).² We interviewed almost 1,000 customers about their personal backgrounds, attitudes towards various types of food and opinions on food safety. This survey demonstrated that Chinese consumers' *awareness* ('have you heard, seen, or read about') is not exceptionally low compared to other countries in the world. However, their

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1. See for instance Hoban (1997). Another useful review, although not published in a peer-reviewed journal, is Kamaldeen and Powell (2000). A meaningful comparison of these studies is complicated by national differences in the adoption rates of GM crops and derived food products, differences in national legislation, as well as differences in survey methodology and the questionnaire design. Regarding the latter, there is often a blurred use of concepts such as consumer 'awareness', 'perception', 'attitude', 'knowledge and understanding', 'acceptance' and 'education' on issues of biotechnology.
 2. Additional information on the survey, including the demographic characteristics of the sample, and a breakdown of responses based on such criteria as gender, age and income, is available from the authors.

understanding of the most basic concepts of biotechnology ('do non-GM products not contain genes?' and 'can eating GM food alter one's genes?') is limited, and most likely substantially lower than in most other industrialized countries. Our survey has also found that few consumers oppose eating GM food, although the overall majority is actually neutral. More importantly, we show that additional, neutrally-worded information about GM food had a great impact, driving down the willingness to buy GM food. The additional information also substantially narrowed the difference between those initially in favour of GM food and those against it. We argue that this effect demonstrates the malleability of the Chinese consumer in a context of limited understanding and restricted access to information (both negative as well as positive).

This contribution is divided into four sections. We begin with an overview of China's biotech and biosafety policies, based on recent literature, official Chinese sources, and interviews with GMO experts and supermarket managers. In the subsequent two sections, we provide more detailed information on soybeans and GM food labelling, and the state of Chinese public opinion on GM food before the new labelling regulations. The final section presents a detailed analysis of the survey data regarding questions on food safety in general, biosafety and human health, the necessity of labelling and the willingness to consume and buy GM products.

THE POLITICAL ECONOMY OF CHINA'S BIOTECH POLICIES

All over the globe, farmers, governments and food retailers have to respond to the new challenges of biotechnology. In the United States, GM crops have received the benefit of the doubt, as long as they have 'substantial equivalence' and show no evidence of negative impact on health and the environment. Here, GM labelling is voluntary. The US has been the world leader in the cultivation of GM crops for many years and currently accounts for 59 per cent of the total world acreage of GM crops (International Service for the Acquisition of Agri-Biotech Applications, 2004). The EU, on the other hand, has followed a more cautious path by instituting a five-year moratorium in 1998. This moratorium was lifted in July 2003, when legislation was passed to meet environmental and health safety concerns, to protect the interests of producers of traditional and organic crops (through zoning requirements to be worked out by the member states), and to uphold consumers' 'right to know' through labelling. Under the new rules, the food industry is obliged to transmit and retain relevant information at each stage from the farm to the consumer for five years, even if the final product has no more DNA or protein of GM origin (Prakash and Kollman, 2003).

By comparison, China has generally adopted a positive position towards GM crops. China has more farmers and more consumers than any other country in the world. Over the past decade, it has invested heavily in

agricultural technologies that improve quality and increase output of grain, cotton, oil crops, fruit, vegetables and other crops. Biotechnology is one instrument. China is presently the fourth largest grower of GM crops (after the US, Argentina and Canada), and accounts for the world's largest acreage in pest-resistant Bt cotton.³ In 2003, Chinese and Monsanto Bt cotton varieties covered 51 per cent of China's total cotton area (Huang et al., 2002; Huang and Wang, 2003). However, Chinese and foreign biotech and seed companies have found it hard to muster sufficient capital to invest and grow because of illegal copying of GM cottonseed by farmers themselves. Monsanto has frequently complained about 'fake' seeds being sold under its name.

China does not want to become dependent on foreign (particularly US) seed companies for cotton or grain seed. Therefore, while allowing joint ventures with foreign companies such as Monsanto, the Chinese government has supported setting up Chinese biotech companies (such as Weiming and Biocentury) that develop GM seeds and supply them more inexpensively. Moreover, there is a self-propelled development pushed by Chinese bioscientists at research institutes and universities and subsidized by the Ministry of Science and Technology. There has been a shift in research funding away from qualities that are useful in poverty reduction (such as drought resistance) to those that offer higher returns: disease and insect resistance, protein enhancement and 'golden rice'. Many genetically-modified organisms (GMOs) have been approved for field trials or environmental release in China. Between 1996 and 2000, China approved forty-five GM plant applications for field trials, sixty-five for commercial release, and thirty-one for commercialization. By January 2003, trials had been approved for wheat, maize, potatoes, soybeans, rape, peanuts, cabbages and rice (Huang et al., 2002).

A confidential study prepared for China's State Council in 2001 was quite straightforward: 'GM organisms do not pose a higher risk than varieties bred through ordinary breeding. The greater risk lies in a state that neglects to use these powerful techniques in order to solve the daily increase in food demand. . . . China should not accept being controlled by others' (Ma and Wang, 2002: 517). The study recommended a dual strategy for imports. With crops for which China was temporarily unable to achieve commercial production (such as transgenic wheat and beans), it should use a high threshold for biosafety techniques in order to delay import of foreign products. In the meantime, China should strengthen its research and development (R&D):

Once our independently developed products are ripe, we could open our markets again. For crops that have rather great risks for safety and ecology or in cases where we may occupy the

3. Bt cotton contains genes from the bacterium *Bacillus thuringiensis* that produce toxins against bollworm in the plant.

world market with non-transgenic crops, such as rice and vegetables, we may stop imports of foreign products for a certain period, and give as a reason that within China R&D of these crops is forbidden. (Ma and Wang, 2002: 517)⁴

In fact, Monsanto claims that its Bollgard cotton has been subjected to much more severe biosafety testing and geographical limitations than domestic Bt strains.⁵

In the same report the authors gave a number of reasons for the Chinese state's support for agricultural biotechnology: China needed to increase its unit grain yield by over 40 per cent by 2030 in order to feed its growing population; Bt cotton had been quite successful and had already brought over five billion yuan⁶ in farmers' benefits; agricultural production costs had to be lowered in order to compete with foreign imports since China's entry into the World Trade Organization (WTO); farm incomes needed to be increased; biotechnology was the future battleground for international competition. Therefore, during 2001–2005, China's investment in biotechnological R&D and commercialization should triple, compared to the previous five years, to more than 10 billion yuan.

Developments in China caused concern among critical foreign and domestic observers. Some even predicted a 'genetic Bhopal', because 'regulatory arrangements may be weaker in less developed countries, more difficult to manage or more easily subverted, leading to lower standards for food safety and environmental protection' (Kydd et al., 2000: 1137). However, a recent study demonstrates that current biotech politics in China actually feature complex dynamics with various checks and balances, while the state displays a deeply ambivalent position towards biotechnology (Zhao and Ho, 2005). China's biotech policies waver markedly between concerns over biosafety and developmental goals such as economic development, food security and poverty reduction. Especially after the 2000 US StarLink corn crisis affected international marketing prospects, China has grown more cautious. With food crops, the government has been careful in allowing field experiments and has not permitted commercial releases to date (with the exception of delayed-ripening and virus-resistant tomatoes and MV-resistant sweet peppers in 1998/9). In addition, the Cartagena

4. The authors of the report also warned against false publicity: 'The problem of GMOs is sensitive, and we should keep reports about transgenic crops strictly in check, in order to prevent unsuitable news and stirred-up [*chaozuo*] reports, and reduce negative impacts. We should not engage in too much media reporting' (Ma and Wang, 2002: 518).

5. William Deng, pers. comm., 2004. William Deng is a senior researcher in the R&D department of Monsanto China.

6. From 1994–2005, the yuan was pegged to the US dollar at 8:2770. Since 21 July 2005 the yuan is linked to several currencies including the dollar, euro and yen at 8.11 against the dollar. The yuan can now fluctuate within a bandwidth of 0.3 per cent upwards or downwards.

Protocol on Biosafety has been signed by China (unlike the US) and now awaits ratification.

China qualifies its GM policy as 'positive in research, careful in popularization, strengthening management, and safe promotion' (Lin, 2003). However, it should be noted that different sections within the Chinese government represent and defend different interests. The Ministry of Agriculture (MAGR) is the leading agency for regulations on agricultural biotechnology, to the regret of those who believe that the State Environmental Protection Agency (SEPA) should play a greater role,⁷ as well as those who favour a greater role for the Food Industry Bureaus.

China's scientific community is deeply divided between those who are enthusiastic about biotechnological progress and its future economic benefits, those who are concerned about the irreversible impact of escaped GM crops on wild and domesticated varieties, and (somewhere in the middle) those who believe it is only a matter of years before insect resistance will become ineffective. The various interests and views come together in the Safety Evaluation Committee of GM Agriculture, which makes recommendations to the Minister of Agriculture about trials, release and commercialization of biotech crops. The Chinese government has promoted the study of the environmental and health effects of GM crops.⁸

Like the EU (but on a much larger scale) China is considering zoning, with entire provinces growing either GM or GM-free crops. For instance, MAGR considers that for export and environmental reasons, Xinjiang province should grow only GM-free Bt cotton and tomatoes and Yunnan province only GM-free rice. In the interest of exports, the Northeast should maintain its GM-free status for soybeans and rice (Lin, 2003). It is thought that zoning will facilitate inspection and control and ensure the separation of trade flows and provision of GM-free certificates as demanded by the EU and other foreign importers.⁹

However, the practicality of zoning in the Chinese context can be questioned. The current biosafety control regulations are poorly enforced, while the local biosafety management institutions under the Ministry of Agriculture are weak and understaffed. In addition, after the recent liberalization of the

7. Which it might get under the new Biosafety Law that the Ministry of Science and Technology and SEPA have drafted (*China Daily*, 2003: 2; pers. comm., SEPA official, 5 November 2003).

8. Research on allergenicity and corresponding evaluation methods, standards and rules were established in 2000. However, a blood data-bank of allergic incidents has not yet been established, and evaluation standards do not conform to international standards (Lu and Liu, 2003).

9. It will also help protect China's organic food crops that are now grown on more than 700,000 hectares and account for US\$ 25 million in annual exports. In 2002, Jiangsu province adopted rules to protect designated organic food zones from the sowing, cultivation or processing of GMOs within a 1 km zone (State Environmental Protection Agency, 2002: 861).

seed market, a wide variety of private and semi-private seed companies has emerged, most of which escape government control. Many of these domestic companies actually sell GM seeds as non-GM in order to circumvent the complicated and expensive biosafety application procedures with the Ministry of Agriculture. For instance, the Bt cotton seed variety Zhong29 was not approved as a GM cotton variety in Anhui province. However, it is still widely cultivated as it was submitted for approval to the Ministry of Agriculture as a conventional cotton variety. According to Xue Dayuan, the former deputy director of the Biosafety Office of SEPA, the 'GM-free' zone of Xinjiang is already cultivating Bt cotton — mainly a 'pirated' version of Monsanto's 33B — on a large scale. It is estimated that around 2.0 million mu (1 mu is 1/15 ha) of Bt cotton was cultivated in 2004 (Xue, pers. comm., 2004; Zhang, 2004). China's poor control of the biotech sector was also revealed by a recent incident involving the illegal cultivation and selling of GM rice in Hubei province. It is estimated that between 950 and 1,200 tons of GM rice had illegally entered the food chain in 2004.¹⁰

China's entry into the WTO gave an impetus to the adoption of protective measures against foreign imports of GMOs. In May 2001, the State Council issued Safety Regulations on GM Crops, and two months later (under pressure from premier Zhu Rongji) the Ministry of Agriculture passed Regulations on Labelling Agricultural Transgenic Organisms. In April 2002, the Ministry of Health issued Health Regulations on GM Food, which also demanded labelling and added the requirement that if transgenic food products originated from potentially allergenic food, they should have a label saying that people who were allergic to GM food should be careful. These sets of regulations have drawn criticisms from Chinese industry representatives as having been adopted too hastily without regard to costs and the lack of low-cost testing equipment for GMO detection.¹¹ The haste has been attributed to China's wish to have trade regulations in place before WTO entry. Even though the MAGR regulations demanded that five categories of GM food products be labelled by 20 March 2002 (soybeans, corn, rapeseed, tomatoes and their derived products, and cottonseed), it was not until July 2003 that these regulations began to be implemented domestically — and then only for the category of soybean oil.

During that time, foreign imports of agricultural products in these five categories were subject to administrative approval, which required that they be certified not to cause harm to humans, animals or the environment, that

10. In April 2005 Greenpeace China found that unapproved GM rice was being sold and grown illegally in Hubei Province (Greenpeace China, 2005). See also the report by *Newsweek* (2004).

11. The rules have a labelling threshold of 0 per cent, which would make them the world's strictest, but an expert of the MAGR Supervision and Testing Centre for Agricultural Product Quality stated that a subsequent technical attachment mentions a 1 per cent threshold (pers. comm., 11 November 2003).

they should be for sale in the country of origin, and that their labelling should note the use of GM ingredients (Foreign Agricultural Service, 2002). One reason for the delay in the implementation of food product labelling was that the organization of inspection and verification had not been completed; another reason was that China's food industry needed more time to restructure its production process in line with the new regulations. However, with China's weak civil society (Ho, 2001), the environmental and socioeconomic risks of biotechnology receive only limited attention in the public media. According to *The New York Times*: 'Enthusiasm for the new science abounds. There is no public debate to stir up the opposition that has brought the development of genetically modified crops to a near standstill in India', and 'with no independent news coverage . . . consumers are unaware that they are eating modified food' (Smith, 2000: 5).

In this context, it is important to assess the current level of awareness of Chinese consumers and their perception of the risks of GM food. Before turning to the analysis of our survey data, however, we will first discuss China's labelling regulations with particular reference to the production of soybeans and the sale of soybean products.

SOYBEANS AND LABELLING OF GM FOOD IN CHINESE STORES

Within China there is a huge demand for soybeans; the country has become the world's largest importer of soybeans, most of which are genetically modified. The beans are crushed in coastal factories. Because of their high fat content (22 per cent), imported beans are more suitable for making oil than domestic beans, which have a fat content of 19–20 per cent; partly because of US subsidies, imported soybeans are also cheaper.¹² The demand for soybean dregs and soy protein for animal feed is also increasing. Under pressure from the US Department of Commerce, domestic traders and the food industry, interim rules were adopted to ease the restrictions described above; these rules shortened inspection times for imported GM crops from 270 days to 30 days, and normal imports of GM-labelled soybeans were restored. In February 2004, the Chinese MAGR approved three- and five-year import safety certificates for Monsanto's Roundup Ready soybeans and a few other Monsanto products.¹³

12. Imports reached 14 million tons in 2001, fell to 11.3 million tons in 2002 because of the administrative barriers of the new import regulations, and jumped to 20.7 million tons in 2003 (Lin, 2003).

13. These products included one version of Roundup Ready corn (which allows growers to use glyphosate-based herbicides that have a favourable environmental profile), YieldGard Corn Borer and Bollgard cotton (which protect themselves from certain insect pests), and Roundup Ready cotton.

After the MAGR's GM labelling rules had been promulgated for some time, some Chinese media started to wonder why they were not implemented, saying that consumers had the right to know and choose under the Cartagena protocol (see, for instance, *China Daily*, 2004b). In July 2003, the Beijing Municipal authorities fined manufacturers of fourteen brands of soybean oil for not labelling GM ingredients. Local TV and newspapers publicized the labelling requirement for soybean oil. Later that month, supermarkets received faxes from the Agricultural Bureau ordering them to stop selling non-labelled GM soybean oils. In some supermarkets, the suppliers of cooking and salad oil withdrew their stock and substituted it for labelled products. In other supermarkets (including Carrefour), local staff stamped their stocks with a temporary notice indicating its GM origin. In early August, inspectors found a high compliance rate at Beijing's markets and supermarkets. Offenders had their products confiscated and were fined 10,000–50,000 yuan.

Some companies apparently had prepared better than others. Almost all labels said that the product originally had used transgenic ingredients but no longer contained transgenic elements. They used the least explicit of the three types of labels prescribed by the MAGR labeling regulations: labels of products containing GMOs should read 'transgenic ____'; products containing directly processed GM products should be labelled 'Product made from transgenic ____', or 'The processed materials are transgenic ____'. Products that have used GMOs (or processed products containing GMO elements), but no longer have detectable transgenic elements in the final product, should be labelled 'The materials used for this product had [or were] transgenic materials, but the final product no longer contains transgenic elements'. This last label was almost universally adopted.

Some interviewees felt that such labels were designed to minimize consumer concern. An official said the wording was chosen by industry itself, 'which should not have happened because it is not reliable' (MAGR Supervision and Testing Centre official, pers. comm., 5 November 2003). One biologist said it was inaccurate, because even if heating destroys the original proteins, soy oil still contains broken strings of genetically modified DNA. Moreover, regulations said the labels should be easily visible and designed and printed together with the packaging and branding. The Ministry of Agriculture has complained that the food industry has designed the GM labels in a very 'bashful' manner, making them difficult to read for consumers.

Greenpeace has kept up its propaganda offensive by sponsoring a Chinese plaintiff to sue Nestlé in Switzerland (under the Chinese Law on Protection of Consumers' Rights and Interests) for its sale of non-GM-labelled Nesquik in China. This consumer claim has been given some publicity in the Chinese media (*China Daily*, 2004a). Greenpeace Hong Kong (2003) offered a dual-language *Greenpeace Shoppers' Guide to Avoiding GE Food 2003* on its website that put brands of food and drink products from

140 companies into green, yellow and red categories. Red indicates the company's failure to respond or to promise the product was GM-free. The listing reflects mainly US and EU brands and is of little use to mainland Chinese consumers, as it lists Hong Kong brands but not those available in the People's Republic of China.

Our consumer survey was conducted two months after the implementation of the labelling rules. Memories of the introduction of GM labels were still fresh. Some Beijing supermarkets we visited had run out of stocks of soybean oil, because residents had been hoarding soybean oil in response to the rapid price increases of soybean oil following the interruption of imports. Wherever we went, we found that all brands carried GM labels, with the single exception of one leftover old bottle. The most popular brands were *Jinlongyu* (Arawana), *Fulinmen* (Fortune), *Yuanbao* (Gold Ingots), *Hongdeng* (Red Lantern), and *Jinxiang* (King Elephant). Although the labelling campaign was meant to be national, not local, Shanghai followed the labelling rules, as did Tianjin two months later. In other cities, such as Xi'an, some well-known national brands (also including rape oil such as *Liyu* [Golden Carp] and *Jiaoshu* [Bagus]) had followed suit, but others did not. Local oil trading companies and their brands, in particular, continued to sell their products without GM labels. Industry representatives have pointed out that local suppliers might need more time but would comply eventually.

CONSUMER UNDERSTANDING AND ACCEPTANCE OF GM FOOD

A poll of 600 consumers in China found that 62 per cent had a favourable opinion about biotechnology, while only 9 per cent had a negative opinion. At the same time, however, the vast majority of the respondents (99 per cent) had little or no knowledge of biotechnology (Li et al., 2002). A similarly low awareness of GM food issues was found in a Chinese mail survey in 2002, although — in comparison to the first survey — a much higher percentage of respondents (37 per cent and 29 per cent respectively) believed that GM foods were harmful to human health or the environment in the long run (Zhong et al., 2002).

From the results from these surveys, we might reach two conclusions. First, the majority of polled Chinese consumers have little or no basic knowledge of GM food. Second, in the absence of sufficient understanding of biotechnology, and given the restricted access to different sources of information from either side of the debate, the attitudes of Chinese consumers to food safety can easily be swayed in either direction — towards acceptance or rejection of GM food. A similar picture arises from a number of surveys of urban consumer attitudes to GM food which were conducted

prior to the implementation of the GM labelling requirements in July 2003.¹⁴ For these reasons, interview methodology must be designed with care; Chinese cultural and linguistic characteristics must also be taken into account. In our survey, we have taken the very limited awareness of GM and GM food of Chinese urban consumers as a starting point and subsequently tested the effects of information supplied to them on their attitudes. This comes close to a simulation of the future reaction of Chinese consumers to GM food once their awareness has been raised. It should be noted that Chinese consumers' awareness had already been raised to some degree by the government's labelling campaign in the months before our survey.

Predictions about how Chinese consumers would react to labelling have differed. GMO proponents such as Chen Zhanliang feared that 'GMO products would be considered aliens in the market, and people naturally avoid buying such products because they do not know much about GMOs'.¹⁵ Chen has also been quoted as saying: 'The public has a right to know the truth about GM foods, but another truth about human nature is that the more you learn, the less safe you feel' (Fan, 2001: 1). Most scientists expected negative reactions from Chinese customers, explained partly by inaccurate media coverage. Others said that if GM foods really pose no harm, people would finally accept them (*China Daily*, 2004a). According to the supermarket managers interviewed in the survey, however, few if any customers had asked questions about the GM labels. Apparently, no problems were anticipated, because staff and employees of the supermarkets visited (including Carrefour) had not received particular instructions about GM food products. One of our interviewees, a supermarket manager, felt that a GM label meant an official mark of approval of its safety.

Greenpeace believes that better understanding of GM and labelling will lead the consumer to demand GM-free or organic products. Their survey (Greenpeace International, 2003) found that 56 per cent would choose non-GM food over GM food if given the choice; 44 per cent would choose non-GM food even if it cost 10 per cent more than a GM counterpart. The same survey showed that 60 per cent of consumers would not buy GM food even at a discount of 10 per cent. Because almost 60 per cent of respondents did not know about GM food, however, it might be that these answers have

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14. A Greenpeace survey of 1,000 Guangzhou consumers found that 64 per cent did not know that their supermarkets sold GM food products and that 87 per cent felt they should be labelled (Greenpeace International, 2003). A 2002 survey of 289 customers in Tianjin found no link between food safety concerns and attitude towards GM food (Wang, 2003). The lack of awareness is also shown by Xuan and Zhou (2002). A survey of 600 consumers in China, the Philippines and Indonesia found a highly positive attitude towards biotechnology and GM food. When asked about food concerns, consumers did not mention biotechnology spontaneously even once (Asian Food Information Centre, 2003).
 15. Chen Zhanliang, president of the Chinese Agricultural University, director of the National Laboratory of Genetic Engineering, and founder of several biotech companies.

been influenced by the line of questioning (Hepeng, 2003). Greenpeace collected supportive statements from a few dozen food companies in China and concluded that companies and consumers were 'pushing GM food off the shelves' (Greenpeace International, 2003; Phillips, 2003). This may have been wishful thinking: other surveys (including ours) show that this claim is overstated. However, this does not imply that such a scenario might not occur in the future.

The overall picture arising from our data is that the average consumer has little comprehension of general scientific principles of GM food and its production. In the absence of this understanding, a majority of the respondents are uncertain whether they would consume GM food products. When we provided — through carefully designed questions — neutrally-worded background information on the scientific debates on biotechnology, we found a substantial drop in the willingness to buy GM food products.

SURVEY RESULTS: ATTITUDES TO FOOD SAFETY AND GM PRODUCTS¹⁶

Recent Chinese food scandals involving GM contaminated rice, the illegal recycling of moon-cake fillings, and the outbreak of chicken influenza in Hong Kong and Guangzhou have damaged consumers' trust in food safety. This is also confirmed by our study. The survey data in Table 1 reveal that food safety was positively graded by fewer than half of the respondents. Only 17 per cent and 31 per cent of the respondents deemed food safety to be 'excellent' or 'good', respectively. An almost equal number found it was 'not so good' (*yiban*); 6 per cent said it was simply 'bad' (*cha*).¹⁷

Indeed, China's food safety system leaves much to be desired. Standards are incomplete, inspection is weak, and regulations are not sufficiently followed. The market for 'green' and organic food is chaotic,¹⁸ and many products are not tested for safety. Moreover, departmental responsibilities are not clear, and there is a shortage of qualified inspectors (Zhou and Yang, 2002). The relatively negative opinion of food safety in China, although undoubtedly based on actual consumer experiences, may also have been fuelled by repeated government warnings against bad food

16. Note that based on the respondents' answers, we have distinguished three separate groups with special characteristics: the knowledgeable, the willing, and those with farm experience. More information is available from the authors, on request.

17. The 'bad' judgement was given by 9 per cent of men and 5 per cent of women, but otherwise there was little gender or age difference in the answers.

18. The term green food (*lǜse shipin*) refers to food products that meet domestic standards of production involving reduced use of chemical fertilizers and the absence of GM material. Food products from organic agriculture (*youji nongye*) means that the agricultural production meets internationally agreed standards of practice, which includes the total absence of the use of chemicals (pesticides and fertilizers) in the production process. See also the contribution by Sanders in this volume.

Table 1. General Attitude Towards Food (Total and by Educational Group)

Question	Response	Total	Lower educated	Higher educated
(% of valid answers)				
A. How do you grade the safety of Chinese food products? (<i>n</i> = 962)	Excellent	17.2	22	15
	Good	30.9	28	32
	Not so good	41.6	38	40
	Bad	5.9	5	10
	Hard to say	4.5	7	4
B. Do you buy ‘green’ food products? (<i>n</i> = 958)	Yes	86.1	76	90
	Rarely	6.4	10	4
	No	7.5	14	6
C. Are you willing to pay more for ecological food products, produced with less chemical fertilizers and pesticides? (<i>n</i> = 934)	Yes	39.9	34	43
	No	44.2	49	42
	Only non-processed	15.8	17	15
D. Are you willing to pay more for organic food products, produced without any chemical fertilizers or pesticides? (<i>n</i> = 929)	Yes	66.1	53	73
	No	23.0	33	17
	Only non-processed	10.9	14	10

Source: authors' survey

products in recent years. Laws, regulations and standards on food safety have been tightened recently — also due to the newly established Food and Drugs Administration in 2004 — and monitoring procedures are being strengthened.

Our survey showed that a large majority of the respondents had bought green food products; only 14 per cent never or rarely did so. Negative answers were more frequent among those under 25 and those over 54 and twice as frequent in the lower education and income groups as in the highest education and income group. Gender made no difference. The self-professed willingness to pay (WTP) extra for products guaranteed to be from organic agriculture was relatively high: only 23 per cent said they would be unwilling, and 11 per cent chose the qualified answer 'only for non-processed products'. The WTP for products from ecological agriculture was substantially lower at 40 per cent and 16 per cent for non-processed products only. One might infer from these responses that many respondents (rightly or wrongly) thought that they did not already pay extra for green food products.

The remainder of this section examines in more detail the respondents' answers to questions on GM food and its production; biosafety and human health; labelling; and the willingness to buy and consume GM products.

GM Food and Biotech Farming

The self-reported awareness of GM food ('having heard, seen, or read about') among Chinese consumers is relatively high: 71 per cent of

respondents said they had heard of transgenic food products. This finding is similar to the Angus Reid World Poll which surveyed 5,000 consumers in Australia, Brazil, Canada, France, Germany, Japan, the UK and the US on GM foods. In that survey, the average awareness of GM food in seven of the eight countries was 79 per cent, with the lowest score being 66 per cent for the US and the highest 95 per cent for Germany. The exception was Brazil, where only 39 per cent indicated that they had heard about GM food (Angus Reid, 2000). The high awareness of Chinese consumers compared to earlier surveys might be attributed to the government campaign (conducted only two months earlier) for labelling cooking and salad oils based on GM soybeans.

However, as we noted in the introduction, the self-reported awareness of GM does not imply an equally high understanding of the meaning of genetic modification (Table 2). On the contrary, only 18 per cent of our respondents gave correct answers to both our questions testing knowledge about the presence of genes ('Is it false to say that non-GM soybeans do not have genes?') and the capacity of modified genes in animal feed to alter human genes ('Is it false to say that eating GM food may change one's genes?'). Taken individually, the first question had a lower score (27 per cent) than the second one (37 per cent).¹⁹ Compared to studies in other countries, the

Table 2. Awareness and Understanding of GM Crops and Food Products

Question	Yes			No	Don't know/unsure
	Total	Lower educated	Higher educated		
	(% of valid answers)				
Have you heard of transgenic (GM) food products?	71	55	82	18	11
Can you mention some GM crops? Which?	32	26	38	68	
Can you mention reasons for their cultivation? Which?	19	24	22	73	8
Have you eaten GM products and food based on them?	37	30	40	32	31
Have you worn clothes made from GM cotton?	15	20	10	36	49
Is it false to say that non-GM soybeans do not have genes?	27	17	35	19	55
Is it false to say that eating GM food may change one's genes?	37	30	45	15	48

Source: authors' survey

19. These two questions were taken from a recent survey which interviewed only college students (Chern et al., 2002). Compared to that study, our respondents did better than

Chinese consumer displays a significantly lower level of understanding of biotechnological applications.²⁰

This also becomes obvious from the results of other questions we asked. For instance, most respondents were unable to name any GM crop at all. Of the 32 per cent that could, half mentioned just one GM crop, while only 11 per cent could mention more than one. It is interesting to note that few people mentioned the 'wrong' crops (that is, crops that have not been commercialized yet or are still at an experimental/field trial stage in China). The crop most frequently mentioned was soybeans (49 per cent) and soy or vegetable oil (13 per cent).²¹ It is somewhat ironic that GM soybeans (which China imports in huge quantities from the US but does not yet grow) were mentioned so frequently, compared with GM cotton, of which China is the absolute world leader in production. Apparently, government propaganda about GMOs and labelling has not been well understood by most consumers. Only 15 per cent of respondents were aware that at least some of their cotton clothing might have been made from GM cotton. In fact, few people have been able to link the GM soybean message with GM crops in general.

Our study also tried to probe into Chinese consumers' understanding of some aspects of biotechnological farming. Recent studies found that farmers have little comprehension of biotechnology in general, let alone of the potential biosafety issues of the GM crops they grow.²² So, what would consumers understand of biotechnological farming? According to our

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20. For instance, the Angus Reid World Poll found that more than four in ten consumers (ranging from 44 per cent to 58 per cent in the survey countries) had 'a little' understanding about genetically modified foods (Angus Reid, 2000). In a Canadian study it was found that more than 50 per cent of the respondents recognized applications of biotechnology (Optima Consultants cited in Kamaldeen and Powell, 2000). However, it should be noted that the methodologies in the surveys are often different. In our case, we measured 'understanding' in terms of the percentage of correct answers given to trick questions, whereas other surveys often simply ask respondents how they judge their own understanding.
 21. Other 'first crops' mentioned were tomatoes (9 per cent), rice, cotton and maize (5 per cent each). As a 'second crop', soybeans, maize and tomatoes were each mentioned by about 20 per cent of respondents who could name more than one crop, and cotton by 12 per cent; for those who could name a third crop, wheat and cotton were mentioned by 27 per cent and 18 per cent, respectively. Tobacco — China's first GM crop, developed in the late 1980s but halted after some years because of foreign buyers — was mentioned only once.
 22. When asked what the government should do to cope with GM safety problems and guarantee a healthy development of transgenic crops, fewer than 10 per cent felt that government should forbid R&D of transgenic crops; more than 30 per cent said that it should improve the regulatory framework; and more than 60 per cent that it should increase investment in R&D (Ma and Huang, 2003). In another study on risk perceptions of Bt cotton by farmers, it was found that 71 per cent of the sampled farmers could not explain the principle by which Bt cotton resists the bollworm (Zhang, 2004).

survey, very little: only 19 per cent of respondents could mention one or two reasons why farmers grow GM crops.²³ Moreover, of those giving a second reason, almost half gave a wrong answer (such as ‘improving the structure of production’). The lack of understanding of the benefits for farmers might be attributed to the reluctance of the Chinese government and media to report on issues related to genetic modification. As we saw above, the position of the Chinese Communist Party (CCP) and government is that such reporting might upset the general population and could be detrimental to a policy of keeping all options open.

Biosafety, Human Health and the Environment

Initially, most respondents did not seem very concerned about the potential risks of GM food to human health: 82 per cent thought that cooked or processed products were safe, while 71 per cent thought the same about meat. However, views on unprocessed food were negative, with the majority (53 per cent) deeming unprocessed GM products ‘unsafe’ or ‘rather unsafe’ (*bu zemme anquan*); see Table 3.²⁴ We hypothesized that the opinion about GM products would be correlated with respondents’ views on food safety in general: this was confirmed. Those who thought food safety was ‘good’ or ‘rather good’, more often deemed GMO-based products to be ‘safe’ or ‘rather safe’.²⁵ Since there is no scientific basis for a greater concern about consuming meat from animals fed with GM feed, than about consuming processed products based on GM crops, we concluded that the negative attitude to GM food is not directly related to knowledge about its genetically modified nature *per se*. In other words, the negative appraisal of GM products (non-processed or otherwise) reflects respondents’ opinions about differences in food safety between non-processed, processed and cooked food, rather than a well-informed opinion about the risks of GM food.

Most respondents did not believe that GM crops might cause damage to other crops or the environment, but many were not sure: 38 per cent

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23. One half of these mentioned an ‘increase in output’, which does not prove an understanding of the reasons for adoption of GM crops. Less than half of the reasons were specific, mentioning (in order of frequency) positive health effects, reduced pesticide use, lower costs and environmental effects.
 24. These questions (which did not allow the answer ‘hard to say’) had a non-response rate of 11–15 per cent, considerably higher than the 4 per cent for the question about food safety in general, showing a somewhat greater uncertainty about how to assess GM products.
 25. For non-processed, processed/cooked and meat products, the difference in positive appraisal between those who thought food safety was ‘good’ or ‘rather good’ versus those who did not, varied from 6 to 12 per cent, namely 50 per cent vs. 44 per cent, 89 per cent vs. 77 per cent, and 77 per cent vs. 65 per cent, respectively (percentages calculated, but now shown in Table 3).

Table 3. Assessment of Safety of GMO-based Food Products for Human Consumption and Opinion on Food Safety in General

	Response	Total	Lower educated	Higher educated
		(% of valid answers)		
Unprocessed GM food (n = 854)	Safe	26	40	21
	Rather safe	21	19	19
	Rather unsafe	28	17	33
	Unsafe	25	22	26
Processed/cooked GM products (n = 831) ^a	Safe	33	39	26
	Rather safe	49	43	52
	Rather unsafe	15	14	19
	Unsafe	4	2	3
Meat from animals using GM feed (n = 818)	Safe	32	36	28
	Rather safe	39	34	38
	Rather unsafe	22	22	27
	Unsafe	8	8	7
Opinion on food safety in general (n = 962)	Good	17	22	15
	Rather good	31	28	32
	Not so good	42	38	40
	Bad	6	5	10
	Hard to say	4	7	4

Note:
a: of the 831 valid responses for processed/cooked GM products, 16 per cent said ‘good’ and 7 per cent said ‘bad’.
Source: authors’ survey

answered they did not believe it, 29 per cent answered ‘maybe, but nothing important’ (*meishemme liaobuqi*), and only 13 per cent said they did believe that damage might be caused. Even among those who had actually heard about GM food before, the majority (57 per cent) thought GM crops were harmless or found it hard to say that they might do damage. The belief that GM foods might do damage was slightly more prevalent among men, the more highly educated, higher middle and high incomes, and those with farm experience (Table 4). The lack of attention to genetic modification in Chinese education and the media in general may explain why differences between groups are small.²⁶

26. Those who had heard of genetic modification before had a considerably higher total of yes or no answers than those who had not (55 per cent vs. 40 per cent) and were less likely to answer ‘hard to say’ (17 per cent vs. 29 per cent). To a lesser extent, this also applied for internet users. These results suggest that these informants had clearer opinions than others. Of course, this holds true only if one assumes that the answers ‘yes, but not important’ and ‘hard to say’ reflect uncertainty rather than a well-founded opinion. As with studies in other countries, demographic variables had little influence.

Table 4. *Belief that GM Crops Might Damage Other Crops or the Environment*

	Yes	Maybe, but minor	No	Hard to say
	(% of valid answers)			
All respondents	13	29	38	20
Respondents who heard of GM food before	15	27	40	17
Respondents who never heard of GM food	8	32	32	29
Respondents who were not sure	7	28	38	27
Ratio of male : female	16 : 12	33 : 27	33 : 40	18 : 21
Ratio of <25 years old : >54 years old	13 : 13	21 : 36	40 : 38	26 : 13
Ratio of low education : high education	12 : 15	28 : 29	41 : 36	19 : 20
Ratio of low income : higher middle and high income	12 : 17	30 : 26	39 : 35	20 : 21
Ratio of farm experience : no farm experience	16 : 11	32 : 26	35 : 40	17 : 22
Ratio of internet users : internet non-users	15 : 11	26 : 33	40 : 36	20 : 21

Source: authors' survey

Awareness of and Demand for Labelling

The majority of the respondents (55 per cent) said they did not know the government had promulgated new labelling rules for GM food. Even among the highly educated, a high proportion was not aware of the new regulations (47 per cent). This seems a rather disappointing result for the recent government campaign. After having responded to some questions with positive and negative information about genetic modification, customers were asked whether they felt that the government should make such regulations: 66 per cent said 'yes', 10 per cent said 'no', and 24 per cent were 'not sure' (Table 5).²⁷

Asked for which of four given types of products labelling was needed, 58 per cent of the respondents indicated processed and cooked food products, including edible oil and drinks, 37 per cent meat from animals fed with GM feed, 35 per cent non-processed food, and 17 per cent cotton. Considering

27. The awareness of labelling rules was positively related to age. People under 25 years old were less aware, and those over 54 were more aware, of GM rules (33 per cent and 55 per cent respectively). However, a smaller than average majority of these two age groups (63 per cent and 57 per cent respectively) felt a need for them. The less-educated felt much less need for such rules than the highly-educated. Lower-income people also expressed a lesser need (56 per cent). The majority of those who believed they were consuming GM food products knew about government rules (67 per cent). In addition, they accounted for a higher percentage of those who felt that labelling was needed versus those who thought not or did not know (77 per cent vs. 60 per cent and 61 per cent). There was also a relation with willingness to pay for guaranteed GM-free food: 52 per cent of the willing, but only 37 per cent of the unwilling, had heard of GM regulations, and 75 per cent as opposed to 55 per cent felt such rules were needed. Those willing to pay for organic agricultural products scored highest, 78 per cent feeling there should be GM rules (vs. only 44 per cent of the unwilling).

Table 5. Awareness of and Demand for Labelling of GM products

Question	Response	Total	Lower educated	Higher educated
(% of valid answers)				
Do you know if government made rules for labelling GM food products? (<i>n</i> = 958)	Yes	45	31	53
	No	55	68	47
Do you hold there should be such rules? (<i>n</i> = 959)	Yes	66	51	82
	No	10	16	5
	Don't know	24	33	13
If yes, for which products? You may choose more than one (<i>n</i> = 941)	Unprocessed	35	39	37
	Cooked	58	49	63
	Feed	37	30	47
	Cotton	19	19	20
Of above, choosing only one (<i>n</i> = 654)	Unprocessed	15	26	12
	Cooked	33	29	28
	Feed	13	13	14
	Cotton	8	9	6

Source: authors' survey

the expressed greater worries about the safety of non-processed GM food versus processed or cooked GM food, it may seem strange that non-processed products were mentioned less often. However, the high percentage mentioning processed and cooked food products may be attributed to the fact that, to date, labelling requirements have been implemented only for edible and cooking oils. Animal feed and cotton were not included in the 2002 MAGR list, but several fresh products such as peppers and tomatoes were. Another (probably very minor) explanation may be that some customers may have doubted the practicality of labelling fresh products and feed.

Consumption and Purchase of GM Food

As we saw above, consumers show a very limited understanding of GM food and its production. In the absence of such knowledge, most consumers remain neutral or unwilling to consume GM food. However, positive and negative information about the potential allergenicity of GM food has a great impact on the willingness to buy.

We asked four different questions regarding the willingness to consume GMO-based food products. Given that the recent labelling requirement so far extends only to soy oil (and sometimes rapeseed oil), the Chinese consumer is not offered a real choice between the same products with or without GMOs. Moreover, GM soybean oil is cheaper than non-GM soybean oil. Since September 2003, some imported brands have labelled rapeseed (and canola) oil as based on GMOs, but most domestic brands do not. If the Chinese customer wants to be absolutely certain of consuming GM-free oil, this can only be done by purchasing more expensive sunflower and peanut

oil. In view of this limited availability and the lack of relevant knowledge on the part of most customers, we decided to ask first about the willingness to consume, then provide positive and negative information about pesticide use, health, the environment and government labelling requirements, and only then ask for willingness to pay for slightly more expensive food products that are guaranteed to be free from transgenic elements (see Table 6).

The initial willingness to consume food containing GM-based ingredients was rather high, 40 per cent being 'very' or 'rather' willing. However, the majority of respondents were neutral (51 per cent), or 'rather' to 'very' unwilling (a total of 9 per cent) to consume GM food. As was to be expected, willingness to consume was positively associated ($p < 0.01$) with a belief in the safety of food in general ($r = 0.249$) and negatively associated with trust in the safety of GM non-processed food, processed food and meat ($r = -0.116$, -0.130 , and -0.270). Knowledge about genes ($r = -0.216$ and -0.279) and education ($r = -0.109$) were negatively correlated. There were less significant ($p < 0.05$) positive correlations with having farming relatives ($r = 0.071$), with not buying green food ($r = 0.066$), and, surprisingly, with the belief that GM crops pose a danger to the environment or other crops ($r = 0.075$). However, we should not simply conclude from the latter result that consumers did not care about environmental effects. The answers may have been influenced by positive information about the

Table 6. Willingness to Consume GM Food Products

Question	Response ^a	Total	Lower educated	Higher educated	Score ^b
A. Willing to consume food containing GM-based ingredients? (<i>n</i> = 946)	1	17	22	12	1.90
	2	23	23	24	
	neutral	51	49	51	
	3	7	5	9	
	4	2	1	4	
B. If with less pesticide use?	1	30	34	24	1.95
	2	48	39	53	
	3	20	23	21	
	4	2	5	2	
C. If some allergic reactions possible?	1	11	13	7	2.33
	2	41	43	46	
	3	43	39	43	
	4	5	6	5	
D. Willing to pay for GM-free food?	Yes	31	31	33	2.62
	No	40	48	36	
D1. Only for non-processed products?	Yes	29	21	32	

Notes:

a: 1 = very willing; 4 = very unwilling.

b: Based on unrounded figures; 'yes' weighted as 1.5, 'no' as 3.5.

Source: authors' survey.

reduced pesticide use required by GM crops. In the light of the limited awareness and information, it is not surprising that one half of respondents adopted a neutral attitude towards the consumption of GM food.

In subsequent questions about the purchase of GM food, we forced respondents to abandon this neutral position, so we cannot directly measure the effect of positive information about reduced pesticide use. After asking, 'if GM crops use less pesticides than non-GM crops, how willing would you be to buy GM agricultural products and products based on them?', willingness went up to 78 per cent of respondents. The fact that our calculated unwillingness score went up from 1.90 to 1.95 instead of down (Table 6) suggests that the initial 'neutral' answer concealed a less positive attitude than average.

Subsequent negative information contained in our rather cautiously phrased question, 'some scientists say that GM food products may give allergic reactions with a few people, but other scientists do not agree; if you knew this debate was going on, would you still buy GM food products?', strongly decreased the willingness to buy GM food. In fact, the average willingness dropped by a quarter, to 52 per cent (Table 6).²⁸

CONCLUSION: SCENARIOS OF CONSUMER RESISTANCE?

China's unprecedented economic development, industrialization and urbanization have been accompanied by profound changes in the food chain — with potentially grave implications. Although China's agricultural production chain is different from that of the West,²⁹ Chinese consumers were wrong to assume that they were safe from food crises, such as the bovine spongiform encephalopathy (BSE) that hit the UK. This was painfully demonstrated with the outbreak of severe acute respiratory syndrome (SARS) in spring 2003. Nobody could have predicted that the consumption of civet cats in South China would have caused such dramatic domestic and global consequences. During the following year, Chinese consumers were plagued by news about carcinogenic substances in Lee Kum Kee's oyster sauce and toxic chemicals in Long Kou rice vermicelli. The deaths of hundreds of infants due to bad-quality baby milk powder in Anhui in 2004 shocked public opinion. In this way China is not so different from

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28. The less-educated reacted less strongly to the allergy question, their willingness dropping by 16.5 per cent, to 56 per cent. In addition, 31 per cent said they would be willing to pay more for GM-free food, while 40 per cent would be unwilling to do so. More (48 per cent) of the less-educated were unwilling. Moreover, 29 per cent of the total (and 21 per cent of the less-educated only) limited their willingness: they would pay more for non-processed natural food products, but not for processed products and cooked food. Income was not a factor.
 29. A large proportion of Chinese agriculture is still conducted in a semi-traditional manner on small plots with high labour inputs and a low level of mechanization.

industrialized societies: the increasing scale, complexity and diversification of food production and consumption also entail problems of food safety.

In this light, the Chinese government's relatively positive stance towards allowing GMOs into the food chain is remarkable. The critical question is whether Chinese consumers are sufficiently aware of the potential risks of GM food — particularly in a semi-authoritarian context with restricted freedom of press and speech. This was the background for our survey on Chinese urban consumers' awareness and acceptance of GM food products. From the survey, we can draw four critical conclusions.

First, the majority of respondents (71 per cent) had heard of transgenic food. This high percentage is most likely due to the government campaigns to raise awareness for the new labelling rules. However, it should be noted that a substantial proportion of consumers (55 per cent) said they did not know the government had promulgated new labelling rules for GM food — even among the highly-educated respondents, almost half were not aware of the new labelling rules. These results point to a larger underlying problem: Chinese citizens' widespread lack of basic understanding of GMOs and their potential risks to the environment and human health. Our survey data confirm this picture, which brings us to our second conclusion. A clear majority of urban consumers (over 80 per cent) had no inkling about genes and could say whether the statement 'non-transgenic soybeans do not contain genes, but transgenic soybeans do' was true or false. The same applied to the question about whether eating transgenic food could alter a person's genes. Furthermore, elementary knowledge about biotech farming and its potential environmental risks was also lacking among our respondents. For instance, most consumers were unable to mention any genetically modified crop at all, and few people could relate GM soybean to GM crops in general.

Third, in the absence of sufficient understanding of GM food, and limited access — or rather, lopsided access, as it is dominated by government and business sources — to information, Chinese urban consumers' acceptance of GM food safety can move in quite opposite directions. Initially, our survey showed that only 9 per cent of Chinese respondents are unwilling to consume GM food. This figure is substantially lower than in other countries, where the trend toward GM foods is perceived more negatively, such as in Japan (82 per cent unwilling), Germany (73 per cent) and France (71 per cent) (Angus Reid, 2000). Even in North America, where overall support for biotechnological applications for agriculture is higher,³⁰ 51 per cent of Americans and 59 per cent of Canadians hold negative views about GM food. These figures have increased from 45 per cent in both the US and

30. Based on a survey of 1,000 citizens in twenty-five countries by Environics, an environmental polling firm, it was found that the acceptance of biotechnological applications for agriculture varies widely per country. These could range from as high as 78 and 76 per cent in the US and India, to just 36 and 29 per cent in the UK and Spain (Environics figures cited in Prakash and Kollman, 2003: 627).

Canada in 1998.³¹ Although only a small proportion of Chinese consumers definitely would not consume GM food, it is crucial to realize that a substantial proportion of Chinese consumers expressed neutrality on this issue (51 per cent). When we provided both positive and negative background information on the scientific discussions on GM food risks (through carefully designed and neutrally-worded questions), the willingness to purchase GM food products dropped substantially (by 26 per cent). This is a significant result that might point to future scenarios of widespread consumer resistance against GM food, as has occurred in various countries in the EU.

Our final conclusion is that the survey demonstrates the critical role of the state in China's political economy of biotech. The poor understanding of biotech and its potential risks can in large part be attributed to the state's reluctance to allow the emergence of uninhibited public debates about genetic modification. This reluctance is not just driven by a fear of social unrest, but most likely also by a felt need to protect the domestic biotech industry against potential consumer resistance. According to Xue Dayuan, former deputy director of the Biosafety Office of the State Environmental Protection Agency, in 2004 the State Council had issued a confidential notice to relevant state institutions, which called for a halt to discussions about biotechnology in the media (Xue Dayuan, pers. comm., September 2004). This is not to say that the Chinese state discourages reporting about biotech altogether: rather, it is a matter of state-guided, 'well-balanced' reporting about biotech.³²

The proactive and dominant role of the Chinese state in the biotechnological arena is also demonstrated by the fact that no domestic NGOs have made biotechnology their field of activity in Chinese society today. To date, Greenpeace is the only NGO that has worked in this area, and it has done so only with great caution due to past confrontations with the government.³³ It is therefore no wonder that information about food safety in

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31. Over half of the consumers surveyed in Japan, France, Germany, Australia and Canada view the issue in a health and safety context, followed by 44 per cent of Americans and 39 per cent of consumers in the UK. Only in Brazil, where awareness of the issue is the lowest, it is seen largely as a science and technology issue (61 per cent) (Angus Reid, 2000).
 32. This was demonstrated, for example, by China's first article about biosafety of GM crops in the nation's main government newspaper, the *People's Daily*. This article was written by Mang Keqiang, a reputable professor at the Institute of Microbiology of the Chinese Academy of Sciences. He warned that 'once agricultural transgenic plants and micro-organisms are released and spread into the environment, they might be difficult to control (*yi shifang tuiguang, ze nanyi kongzhi*)' and hoped that the 'involvement of other concerned experts in the discussion will bring these questions to the attention of governmental policy makers and the administrative departments in charge of research funds' (Mang, 1996). It is important to note that Mang Keqiang did not write on a personal title, but had been invited by the central authorities to do so (Mang Keqiang, pers. comm., 2002).
 33. The Greenpeace office was reopened in spring 2002 after being closed down in 1995 because of an incident in August of that year when public security personnel arrested six foreign Greenpeace demonstrators, detained them for one day, and expelled them from China for unfurling an anti-nuclear banner in Tiananmen Square.

relation to biotech almost exclusively comes through government channels. In a recent survey of 1,000 Chinese respondents, it was found that less than 3 per cent had heard about GM food through environmental NGOs.³⁴

This is not to argue that increased information from environmentalists and critical consumer organizations will automatically lead to a *decrease* in consumer acceptance of GM foods. In fact, empirical studies have demonstrated that the acceptance or the rejection of biotechnology is not directly dependent on awareness, or even the understanding of it (Powell, 2000: 399). In other words, regardless of whether citizens are aware or knowledgeable, they will continue to make judgements on the potential risks and utility of these technologies. Researchers have attempted to unravel this enigma by studying a great variety of variables that might influence consumer acceptance, including the level of education on biotechnological applications, attitudes on ethical, safety and environmental issues, the sources of information (government, scientific organizations, NGOs, businesses, and so on), and their perceived trustworthiness, or 'source credibility' (see, for instance, Braun, 1999; Frewer et al., 2003; Powell and Leiss, 1997). In this respect, a critical factor is consumers' *perceived* level of exclusion or inclusion in decision-making processes (Hagedorn and Allender-Hagedorn, 1997). However, in the current Chinese political and institutional constellation, citizens might feel they have been insulated from important new developments, while scientists and entrepreneurs are actually emboldened to forge ahead with these developments without checks and balances. In that process, China runs the risk of losing something that might be useful, and adopting something that has not been sufficiently tested or debated for its potential dangers.

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34. Of the interviewees, 37.2 per cent had heard about GM food through the media, 12.8 per cent through friends, 12.3 per cent through books and articles, 2.8 per cent through school, 2.0 per cent through the government, and 1.5 per cent through companies (Green Community Research Centre, 2002).

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