RISK PERCEPTION, TRUST, AND LEGITIMACY: THE INTERACTION OF STATE AND SOCIETY IN CHINESE GENETICALLY MODIFIED FOOD GOVERNANCE

Iris Kim
London School of Economics - Peking University

Societal acceptance of genetically modified organisms (GMOs) lies at the core of a politicized quagmire of state, society, and scientific actors. China presents a special case for study of the GMO issue because public opinion and state regulations on biotechnology have shifted to oppose each other. This research seeks to answer the following questions: 1.) Why has the Chinese public grown more suspicious of the risks associated with genetically modified foods since the 1990s, and 2.) To what extent is the Chinese state responsive to societal perceptions of the risks of genetically modified foods? It will seek to answer these questions with state-society relations frameworks of performance and responsibility-based legitimacy. This paper concludes that increasing media and NGO presence in Chinese society has changed how it conceives of the obligations of the Chinese state. Examining acceptance of genetically modified crops in the Chinese state and society reveals the views of a rapidly transforming state and society actors. This research presents a critically important case that adds to the understanding that Chinese market liberalizations and economic reforms have changed Chinese society and the way it interacts with its state institutions. It also lies within a growing body of necessary literature that examines the interactions of scientific issues, state, and society in an increasingly globalized and technologically advanced world.

Keywords: state-society relations, China, risk regulation, genetically modified food

Introduction

Background: China and Modern Biotechnology

In 1988, China commercialized a virus-resistant tobacco plant, becoming the first country in the world to commercialize a genetically modified (GM)

plant.[1] A genetically modified plant, also known as transgenic, has modified or engineered DNA so as to have desirable characteristics, such as resistance to a certain disease. The discovery of manipulating genes has created an entirely new field of science with applications in medicine, manufacturing, and agricultural sectors. However, in any society, new technologies bring about divisive reactions within society and government. With recent advances in biotechnology, such as CRISPR and CAS-9 gene editing capabilities, the change in cost and efficiency of genetic modification is expected to further accelerate in coming years.[2] However, the safety of genetically modified crops and food products for the environment and for human consumption is widely contested in developed and developing countries, as well as by regional and international organizations. Though the scientific community has reached a consensus that GMOs have no adverse health effects, regulation still must err on the side of caution.[3] In China, genetic modification may prove to be a large part of the country's agricultural future as its economy continues to liberalize, while its population ages.[4]

Food security and self-sufficiency have haunted China since the time of Mao's Cultural Revolution and Great Leap Forward policies championed by the Chinese Communist Party (CCP) that resulted in mass starvation. Scholar Lester Brown's book, "Who Will Feed China?" presents a sensationalistic survey of the Chinese agricultural industry. Brown argues that a hungry China and an inability to produce its own grain would mean shocks to the world's grain supply as China seeks grain from other markets. A 1995 Chinese government white paper entitled "China's Grain Issues" (中国的粮食问题), responds directly to Brown's work in its conclusion, stating: "Practice will prove to the world: the Chinese people can not only feed themselves, but also make their quality of life better and better year by year. Instead of forming a threat to the world's grain supply, China will make ever greater contributions to it."[5] The white paper highlights the extent to which the Chinese central government considers food

1 Richard Falkner and Aarti Gupta, "The Limits of Regulatory Convergence: Globalization and GMO Politics in the South," *International Environmental Agreements: Politics, Law and Economics* 9, no.2 (2009): 121.

2 Heidi Ledford, "CRISPR, the Disruptor," *Nature*, June 3, 2015, accessed May 4, 2017, https://www.nature.com/news/crispr-the-disruptor-1.17673.

3 Joel Achenbach, "107 Nobel Laureates Sign Letter Blasting Greenpeace over GMOs," *The Washington Post,* June 30, 2016, accessed May 4, 2017, https://www.washingtonpost.com/news/speaking-of-science/wp/2016/06/29/more-than-100-nobel-laureates-take-on-greenpeace-over-gmo-stance/.

4 Kenneth Rapoza, "China's Aging Population Becoming More of a Problem," *Forbes*, February 21, 2016, accessed May 4, 2017, https://www.forbes.com/forbes/welcome/?toURL=https://www.forbes.com/sites/kenrapoza/2017/02/21/chinas-aging-population-becoming-more-of-a-problem/&refURL=https://www.google.co.uk/&referrer=https://www.google.co.uk/.

5 "The Grain Issue in China (Zhong Guo Liang Shi Wen Ti)," Information Office of the State Council's Annual White Papers, October 1996, accessed May 4, 2017, https://www.iatp.org/files/Grain_Issue_in_China_White_Paper_The.htm.

security, food self-sufficiency, and independence from agricultural imports a national priority.

Today, China has about 21 percent of the world's population and must feed it with 9 percent of the world's arable land. China currently relies heavily on agricultural imports to sustain its food supply, but not to the extent that its imports threaten to unbalance global grain markets.[6] However, taking into account China's transition to a more market-based economy since 1978, and an increased demand for manufacturing jobs, China's agricultural sector is under pressure to increase efficiency. By producing grain and soy seeds that require less agricultural inputs, genetically modified crops present an important opportunity for greater efficiency in agriculture, and thus less reliance on soy imports from the United States.

In 2000, the Chinese government began a de facto moratorium on granting licenses for commercializing genetically modified foods.[7] However, it reversed course on this policy in 2009 with a licensing grant to grow *Golden Rice*, a genetically modified strain with more Vitamin A than normal rice. This particular genetically modified rice prevents blindness in children, a preventable side effect of malnutrition. The approval to grow Golden Rice signifies an important shift in the Chinese central government's regulation of transgenic crops.

The importance of genetically modified foods to China's future thus presents questions that require close scrutiny. This research seeks to answer the following questions: (1) Why has the Chinese public grown more suspicious of the risks associated with genetically modified foods, and (2) To what extent is the Chinese state responsive to societal perceptions of the risks of genetically modified foods? It will seek to answer these questions using state-society relations as frameworks for performance and responsibility-based legitimacy. Examining the central government's regulations of genetically modified foods and changing public sentiment through the lens of these frameworks reveals that a changing Chinese society has influenced the way in which the Chinese government communicates with its public. This research adds to the understanding that Chinese market liberalizations and economic reforms have changed Chinese society and the way that it interacts with its leaders.

1.2 Defining GMOs: Grounds and Justification for Research

The Cartagena Protocol, the largest international framework for biosafety regulations, defines modern biotechnology as the following:

6 John Wang and Yanjie Huang, "China's Food Security and Its Global Implications," *China: An International Journal* 10, no. 1 (March 2012): 115.

7 Robert Falkner, "International Sources of Environmental Policy Change in China: the Case of Genetically Modified Food," *The Pacific Review* 19, no. 4 (2006): 473-474.

> The application of: a. in vitro nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or b. fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers and that are not techniques used in traditional breeding and selection.[8]

The terms "modern biotechnology," "genetic modification," and "transgenic" all are used interchangeably in this paper to describe the aforementioned definition. The term "genetically modified organism" will also be used in this paper to describe the Cartagena Protocol's definition of a "living modified organism," which is "any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology."[9]

The justification for this study stems from a dilemma that the Chinese central government faces regarding the safety of genetic modification. On one end, GMOs clearly present an answer to China's food security dilemma in years to come, especially as its economy transitions from manufacturing to service based. On the other, public acceptance of genetically modified foods would provide a major hindrance to the success of biotechnology endeavors in the food sector. In a 2014 survey of source credibility on the issue of GM crops, 49.2 percent of respondents said that they trust biotechnology research institutes as credible regarding GMOs.[10] Additionally, government offices devoted to the management of NGOs, such as the Chinese Ministry of Agriculture (MOA), had 48.1 percent of respondents' trust. Environmental organizations, such as Greenpeace, had 49.4 percent of respondents' trust on the issue of GMOs.[11] NGOs, Chinese regulatory bodies, and research institutes have more relative support than GMO technological experts, who had 37.8 percent of respondents' trust.[12] Additionally, social reforms during this time period have also created a more highly educated public that consumes larger amounts of media, especially in forms of social media, such as Weibo or WeChat. Open markets and a more highly educated public have also led to Chinese public exposure to genetically modified food products common in the United States. China's status as an authoritarian state, although moving toward a trend of decentralization, means that on social media platforms and in the press, GMO discourse is a state-society interaction. Specifically, the government is able to

8 "Cartagena Protocol on Biosafety, 3i," United Nations Convention on Biological Diversity, January 2000, accessed May 4, 2017, https://bch.cbd.int/protocol.

9 Ibid., 3g.

10 Zhang Mingyang et. al., "Influence of Source Credibility on Consumer Acceptance of Genetically Modified Foods in China," *Sustainability*, 8 no. 9 (2016): 9.

11 Ibid., 14.

12 Ibid., 14.

see and respond to anything published in the Chinese press or social media platforms. GMOs also present an ideal case for examining current state-society interaction in China because they are an issue that garners public interest quickly due to the personal and familiar nature of food.

Genetically modified foods contain unbounded potential as a technology, but societal acceptance of their safety has not followed as quickly as the technology has advanced. Thus, understanding the contention of the issue, as well as wider study of state-society interactions about technology and risk perceptions is vital to proper risk regulation at the state and international level. While the applications of modern biotechnology contain wide and far-reaching potential for uses in modern medicine and pharmaceuticals, their presence in the agricultural market has caused the greatest stir among consumers. Consumer right campaigns in the US, the EU, and China have all demanded labeling on products containing GMOs. Thus, civil society around the world, including in China, has played an important role in pressuring the relevant regulatory bodies to maintain transparency of genetically modified food products. This state-society interaction will only increase in importance as technology advances, as consumers are left to consider the implications of what repercussions such advancement incurs, and how government can react and regulate such technologies responsibly.

2. State-Society Interactions Frameworks

This study utilizes public discourse, acceptance, and regulation of genetically modified foods as a specific case where the Chinese state institutions and civil society interact. the United Kingdom's Department for International Development defines state-society relations as: "Interactions between state institutions and societal groups to negotiate how public authority is exercised and how it can be influenced by people. They are focused on issues such as defining the mutual rights and obligations of state and society, negotiating how public resources should be allocated and establishing different modes of representation and accountability."[13] In applying a state-society relations framework to China specifically, Zhao Dingxin puts forward a state and society relations framework with his examination of the 1989 Tiananmen Student Movement.[14] Zhao's framework identifies the key underlying issues that led to the student movement being ineffective against state control measures that stemmed from "conflicting views of state legitimacy in the minds of top

13 "State-society Relations and Citizenship: Topic Guide, April 2016," Governance and Social Development Resource Centre, accessed May 4, 2017, http://www.gsdrc.org/topic-guides/state-society-relations-and-citizenship/state-society-relations-overview/.

14 Zhao Dingxin, T*he Power of Tiananmen: State-society Relations and the 1989 Beijing Student Movement* (Chicago, IL: University of Chicago Press, 2004).

state elites, movement activists, and the rest of Beijing's population."[15] This study relies on Zhao's framework, which links social protest, discourse, and movement to state legitimacy in the interactions between state and society. Indeed, with regulations of genetically modified foods, civil society and the state have grown to understand the state's role of government regulation differently. Thus, Zhao's framework of state and society interactions fit with this study about genetically modified foods.

In Tong and Lei's understanding, state responses both reflect, and are constrained by, the relationship between the state and society. However, if one of these entity changes, the structure and nature of the relationship is subject to change. This creates a series of dynamic interactions between society and state, especially given ongoing reforms in China's political and economic system. The first way to conceive of state-society relations is to perceive state and society as antagonists. This is performance-based legitimacy, in which the legitimacy of the government is based on past performance of government behaviors and oversights.

A second framework for viewing state-society relations in China is to view the role of the state as multilayered and responsibility-based. This responsibility-based legitimacy theory is rooted in China's political tradition and it emphasizes that the state and society engage with and change each other when they interact, rather than antagonize each other.[16] The responsibility-based approach of state-society interactions portrays state and society in terms of three layers: the morality of the ruling elite, benevolent governance of the ruler, and state responsibility for the well-being of its people. These themes echo ideas of the mandate of heaven and the morality of the ruler; that is, in order to maintain his mandate from Heaven, or legitimacy, the emperor must maintain their morality. If the emperor does not fulfill his obligations, it gives peasants the right to rebel. In terms of the GMO issue and other issues of science, the state has a particular obligation to fulfill in the view of the public in order to keep the unknown risks of new technologies at bay and cautiously regulated. In understanding the case of genetically modified foods, elements of both frameworks are useful in analyzing the state-society interactions in how public opinion has changed and how the state has demonstrated responsiveness to a change in public opinion. Some case studies in this work find that society does indeed directly question the performance of the government in the case of GMOs. Other case studies instead highlight the changing and dynamic

15 Ibid., 209.

16 Tong Yanqi and Shaohua Lei, "Analyzing Social Protest," in *Social Protest in Contemporary China,* ed. by Routledge (2014): 18-46.

interactions between state and society given the transforming nature of the two over the last twenty years.

3. Case Studies

3.1 Introduction to Case Studies

Concerns about food safety caused the public to call into question the central government's ability to keep the public safe from potentially dangerous food. They also question the credibility and legitimacy of science and the overall scientific knowledge of policymakers. Cases such as the Nestle China case and the 2013 Golden Rice Scandal have revealed the indecision and uncertainty of Chinese officials on whether and how to regulate production, testing, and labeling of genetically modified foods. The following case studies highlight Chinese public views of genetically modified food and their safety. Additionally, they are examples of a changing Chinese state and society relationship, which expresses itself in a series of dynamic bilateral interactions.

3.2 Nestle China: Lack of Consensus in Regulation and the Rise of Consumer Awareness

In 2003, Zhu Yanling, a mother from Shanghai, brought a case against Nestle China Co. in Shanghai Intermediary People's Court. She argued that Nesquick powder milk was not labeled with GMO components on the package and that, as a mother and consumer, she had a right to know whether the product contained GM components. Greenpeace is widely credited for publicizing the case and for funding Zhu's trip to Nestle's headquarters in Switzerland. This case has revealed, through media and NGO involvement, that Chinese regulations and standards for GM food were not well maintained or fully decided upon at the time.[17] Publications by Greenpeace about the case also portrayed Nestle as an unscrupulous multinational corporation with double standards towards Chinese and European consumers. The case of Zhu vs. Nestle first highlighted a prominent consumer rights campaign that garnered worldwide media attention. Secondly, it highlighted that in 2003, methods of testing for GM products and subsequent labeling practices were not widely known—a government oversight on regulation.

She claimed that, "Nestle is unconvinced that Chinese consumers are as unconcerned as European consumers on food safety and consumer rights."[18]

17 Xi Wang, Qin Tianbao, and Lu Fu, "Cartagena Protocol on Biosafety and China's Practice," *Asia Pacific Journal of Environmental Law* 8, no. 3 (2004): 93.

18 "Zhu Yanling's Long March for Consumer Rights: Chinese Consumer Challenges Nestle," Greenpeace International, January 7, 2004, accessed May 4, 2017, http://www.greenpeace.org/international/en/

Zhu's statement indicates her perception that Nestle had a double standard in labeling its GMO products in the EU and Chinese marketplaces. Zhu made a powerful statement for Chinese consumer rights and the media support she garnered from fellow Chinese consumers speaks to the emergence of the consumer rights consciousness in the Chinese markets. With the emergence of these rights consciousness, Zhu claims that the standards that multinational corporations have for EU markets should be the same as those for the Chinese markets.

Ultimately, the court ruled inconclusively on the case because there was no Chinese national standard of labeling GM food products at the time. The case used two methods of testing for GM components at different stages of the legal process. In one method, there was enough trace evidence of genetically modified particles to label the Nesquik milk as a GM product. However, in another testing method, there was not. Because there was no accepted standard in Chinese state law in testing for GM foods and traces in these products, the case could not reach a resolution. The Zhu Yanling case ultimately exposed the lack of Chinese regulation on GM foods, which served to only increase public anxiety over the issue.

At this time, the United States and the EU had labeling regulations on GM products. Thus the failing of the Chinese government to not have national standards for testing products for genetic modification indicates either a lack of government oversight on the issue or stark divisiveness within the relevant regulatory bodies on how to conduct testing. With Greenpeace's role in the case, it seems that the original motivation for the case was to expose Nestle's role in keeping information from consumers about whether their food contained genetically modified food products. In doing so, Nestle also exposed the lack of Central Government regulation on genetically modified food. By 2003, genetically modified foods were not new to the Chinese public or to the Chinese government. Thus, a lack of standards on how to test for GM foods gave rise to a consumer perception of the central government's responsibility in regulating proper food labeling.

3.3 GMOs in Chinese Media: The Case of Cui Yongyuan

Cui Yongyuan, an outspoken media personality and ardent critic of GMOs in Chinese households, has an extensive social media following and has played a pivotal role in the media impact on Chinese public opinion. In 2013, he and Fang Zhouzi, a chemical biology expert, engaged in a prolonged debate on Weibo regarding the commercialization and safety of GMO foods. In the next

news/features/chinese-consumer-challenges-ne/.

year, the feud between Cui and Fang escalated when Cui claimed Fang was operating an illegal trust fund, and Fang responded with a libel lawsuit. Cui has also produced an investigative documentary about the regulation of GM foods in Japan and the United States. In a 2015 talk at Fudan University, Cui also questioned a life science professor's credentials, claiming that the professor's lack of knowledge about broadcasting "did not qualify him to debate on the same level."[19] Cui Yongyuan's following, over 10 million on Weibo as of April 2017, is testament to the degree to which the Chinese public consumes the media he produces.

Extensive media coverage in China on GM crops, both positive and negative, has influenced public perception of genetically modified foods, perhaps contributing to the diversity of public views on the issue. More highly educated members of contemporary Chinese society and avid consumers of media tend to have more negative viewpoints of GM foods. One study found that a higher education level of a person meant that they were less likely to accept soybean oil from GM soybeans with age, health, and household income having no correlation.[20] The same study also found that media presence on the issue of GM crops "has resulted in a negative view of GMFs [genetically modified foods], due to dissemination of faulty information throughout the country."[21] The prominent presence of GMOs in social media, as well as in traditional print media, has contributed to divided public opinion on genetically modified foods. While there are studies that do show that biotechnology is well received in the public and that the government is the most trusted source in terms of information about technology, media certainly has shaped public opinion of GMOs. In the information age, stories have become harder to verify.

Cui Yongyuan and his feud with biotechnologist Fang Zhouzi have publicized the rifts of an issue new to society, genetic modification. Both Cui and Fang fervently advocate for the public's right to know the truth about GM foods: Cui from a consumer safety standpoint, and Fang from a scientific one. Cui holds that, "It's exactly because there are so few people who are willing to speak up that I must continue to do so."[22] A China Daily article highlights the public exchange between Cui and Fang as an exchange "focused on rights—the right to question the authority of science."[23] Indeed, this exchange between

19 "Fang Zhouzi Vs. Cui Yongyuan: How an Online Spat about GM Foods Ended in the Courts," *eChinaCities,* August 7, 2014, accessed May 7, 2017, http://www.echinacities.com/china-media/Fang-Zhouzi-Vs-Cui-Yongyuan-How-an-Online-Spat-about-GM-Foods-Ended-in-the-Courts.

20 Zhang et al., "Source Credibility," 14.

21 Ibid., 18.

22 "'Tell It like It Is': China Delegate Rips Meek Congress," *AFP News*, March 14, 2017, accessed May 2, 2017, https://sg.news.yahoo.com/tell-china-delegate-rips-meek-congress-085310883.html.

23 Raymond Zhou, "The Truth is Out There Somewhere," *China Daily*, 2 August 2014, accessed May 7, 2017, http://www.chinadaily.com.cn/opinion/2014-02/08/content_17896965.htm.

a journalist and a scientist highlights the degree to which media in Chinese society has grown in capacity to hold public debate with opposing viewpoints on an issue which technologists around the world are still debating.

Since his feud with Fang, Cui Yongyuan continues to expose government failures and lack of oversight in regulation of GM seed uses. In particular, he has cited a Greenpeace report exposing widespread illegal use of GM seeds in Northeast regions of China. Greenpeace found that 93% of grain samples from Chinese supermarkets contained GMO traces.[24] Cui posted that "some people are openly lying, and they should be fired."[25] Cui Yongyuan's debates and promotion for more stringent regulation of GM foods because of the safety risks they pose serve as a way in which the media has demanded accountability of the Chinese state and regulatory bodies.

3.4 Golden Rice Trials: Ethics and Scientific Advancement

In 2013, it was discovered that scientists at Tufts University conducted trials on the nutritional value of the Golden Rice with young children in rural China. They conducted the trial without explanation to Chinese families what potential health benefits the rice had, or what was in it that created more nutritional value.[26] This incited public outrage after a Greenpeace exposé of the experiment, as the public felt that the crop could have potentially carried risks to their children. Tufts University eventually admitted that it had violated ethics rules in the trial, and that Chinese families and test subjects had a right to know what was in the product being tested. As a result of the scandal, three Chinese officials overseeing the project were dismissed from their posts for their lack of oversight on the experiment.[27] The Golden Rice Scandal again revealed a large government oversight in the regulation and general knowledge about GM crops. It also opened the Central Government to criticism that commercialization and testing of a product took precedence over public safety. The Golden Rice scandal has thus further added to the negative stigma around GM foods, and laid the groundwork for lack of trust in scientists.

---

24 Yap Chuin-Wei, "Ban or Not, GMOs May Already Be On China's Table," *The Wall Street Journal.* January 7, 2017, accessed May 2, 2017, https://blogs.wsj.com/chinarealtime/2016/01/07/ban-or-not-gmo-corn-may-already-be-on-chinas-table/.

25 Ibid.

26 Dan Charles, "Golden rice study violated ethical rules Tufts says," *National Public Radio,* September 17, 2013, accessed December 5, 2016, http://www.npr.org/sections/the-salt/2013/09/17/223382375/golden-rice-study-violated-ethical-rules-tufts-says.

27 Jon Entine, "Greenpeace Hysteria Campaign Scares Chinese into Retreat on Nutrition-Enhancing GMO 'Golden Rice," *Forbes*, December 11, 2012, accessed December 5, 2016, http://www.forbes.com/sites/jonentine/2012/12/11/greenpeace-hysteria-campaign-scares-chinese-into-retreat-on-nutrition-enhancing-gmo-golden-rice/#15ce040ac994.

The 2008 Baby Formula Scandal, in which tainted baby formula caused kidney stones in small children, has made the public especially sensitive to food scandals even before the Golden Rice scandal emerged. The Golden Rice scandal in 2013, provoked public outrage in much the same way, though the responsible regulatory bodies differed in this instance. GM food issues, because they involve food safety issues within the family, can especially strike the hearts of the Chinese public and any society around the world. It undermines consumer confidence in parents who feed their children in hopes of raising a healthy family, and tainted food has served as an attack on the traditional ideals of Chinese family values. Golden Rice in particular explains Chinese society's skepticism of the state's credibility in keeping food safe for public consumption, and GM crops serve as an easy scapegoat. It also adds to the confirmation bias of the Chinese public, based on public memory from the 2008 baby formula crisis.

Applying the public reaction to the Golden Rice scandal to the framework of state-society relations, the failure of government regulatory oversight in small details of the study (such as how trial families were given information about the nature of the technology they were testing) highlights a failing of the government to uphold its responsibility to its people. This ultimately adds to the failure in government performance to serve in a protective capacity regarding questions of such risks as scientific trials on young children. The study involved young children, which also added to the perception that the government prioritized scientific advancement over the safety of children and family, and the notion that public officials who endorsed the scientific advances associated with the study lacked the same morals as the Chinese public. The Golden Rice trials thus introduced the debate about the tension between scientific advancement and ethics to the Chinese public. It has also raised awareness and portrayed the issue as a dichotomy between scientific advancement and economic growth as a challenge to the safety of families and children. In many ways, the Golden Rice trials exposed the rights of society to question the advancement and legitimacy of science and at what cost economic development and improved technology is achieved. The Golden Rice case also highlights a means by which critics of GMOs portray scientists as unethical. The fact that the scientists and regulators in charge of the study lost their job reflects a state sensitivity and responsiveness to how the public perceived the issue.

4. Discussion and Analysis of Case Studies

4.1 Society vs. State: Performance-Based Responsibility

Past governance failures in food safety regulation give rise to public dissatisfaction with the central government's approach in dealing with the unknown regulatory risks of genetically modified foods. Understanding Chinese societal perceptions and discourse surrounding GMOs particularly highlights the degree to which interactions between state and society in China have changed. First, Chinese society is changing with respect to how it interacts with its government due to a rise in a consumer rights consciousness and the emergence of civil society actors. Second, the Chinese state is changing in how it deals with the future of biotechnology, taking public opinion into account. These two changes highlight larger implications about the interaction between science, state, and society in China. In applying the aforementioned case studies to the state-society relations framework and the different elements of Chinese society they encompass, the Chinese public has grown more suspicious of genetically modified foods because the rise of non-governmental actors in Chinese society is leading the people to question the Chinese government's performance in the regulation of genetically modified foods.

GMOs remain mostly in public discourse on social media platforms rather than in public demonstration, but the aforementioned case studies highlight that lackluster government performance and weak oversight in food and environmental regulations have awakened a rights-based consciousness in the average Chinese consumer. This consciousness manifests itself in exposure to open criticisms of the Central Government and its lack of transparency on the GMO issue. The awakening of this consciousness has sprung from demonstrated discontent with the central government's willingness to compromise public health and safety with economic growth. Environmental pollution protests in China indicate wide public sentiment that the central government has failed to perform its duty of maintaining economic livelihood while also protecting well-being. Environmental issues have successfully risen in the public eye because the issue is highly visible in the form of smog over Beijing and other major cities, and is a tangible public health threat. These factors also exist for genetically modified foods. Food safety affects all people in the Chinese marketplace, and is easily relatable as an issue in the media. The issue also underpins agricultural and economic livelihoods, family values, and public health.

The Nestle case of 2003 revealed that the government had been using inconsistent methods to test products for how much genetically modified product they contained. The underlying issue of lack of government oversight

in the Nestle case indicates an awakening of a rights consciousness in Chinese society regarding the safety of food products. From a state-society relations perspective, society has begun to demand to know whether a crop contains a genetically modified food product. This signifies a growing Chinese consumer base with demands to certain rights as consumers and a transition toward a consumer-centered market. The China of today is no longer the "strong state, weak society" model. Instead, Chinese society has vocally expressed its doubts about government credibility with regard to genetically modified foods because of past public health crises regarding GMOs, meat, and baby formula. The Chinese government has thus lost its credibility with keeping food safe for public consumption because of poor past performances with food safety scandals magnified by media. Zhu, with Greenpeace's help, successfully questioned the government and revealed an important oversight and failure in performance, chipping away at the legitimacy of the state in properly performing its regulatory due diligence.

Cui Yongyuan, the journalist and TV personality, has capitalized on social media and his status as a celebrity to deliberately and vocally question the performance of the government in its regulation and oversight of genetically modified food products. Cui's feud with renowned biotechnologist Fang Zhouzi continued the emergence of a consumer rights based consciousness that existed at the intersection of a new technology, civil society consumer rights, and the right for transparency from the government. The feud between Cui and Zhou reveals two aspects when considered at the level of state-society interaction. First, it represents a continuity of the rights-based consciousness awoken with the Nestle Zhu Yanling case, which questioned the performance of the government in keeping the public informed and satisfied with genetically modified food regulations. Second, the feud represents the appearance of the media, especially social media, as a new platform for Chinese state and society interactions.

The Golden Rice trials incited public outrage because the study failed to provide details of the nature of the study, and the possible genetically modified food products in the rice that would be fed to children. The case is thus linked to a lack of transparency and also a lack of ethics in informing parents of the nutritional content that children would be consuming in the study. Understandably, the nature of scientific trials, such as testing for nutritional content, does not allow for all test subjects to know whether they are consuming the tested material or control items in order to avoid the placebo effect. However, in this particular case, the outrage was linked to a parent's right to know about what their children was consuming. Thus, the Golden Rice trials demonstrate a continuation of the demand for transparency in regard to genetically modified food and food products.

The case studies of genetically modified organisms comprise two main common threads consistent with conceptions of performance-based legitimacy. First, new actors have emerged in Chinese civil society by means of new platforms of expression. Cui Yongyuan and the Chinese media, as well as Greenpeace, clearly demonstrate that Chinese state-society interactions are no longer comprised of active protest movements per se. Social media propagates news of Cui and Greenpeace and the Golden Rice trials faster than ever before. Second, these new actors and platforms in Chinese civil society produce new ways to question the government's performance in regulating genetically modified food. The awakening of a consumer market and consumer rights consciousness in China, as well as the demand for transparency in GM regulations, have come as a result of vast changes in the landscape of China's development and social fabric. Public perceptions of GMOs were incredibly positive in the beginning of the 1990s, when the public was less aware of their associated risks that were subsequently exposed by the media. However, as China has achieved large amounts of its economic potential and proved an international paragon of economic growth in a short period of time, the public has grown disenchanted with its economic growth. Food safety is one such issue in which public sentiment is manifested clearly and consciously in the media. The public has also grown more aware of international opinions about genetically modified foods because the China of today has had more international exposure to non-governmental actors, such as outside media and NGOs. Declining public sentiment of GMOs indicates a trajectory in which the Central Government has lost legitimacy in its performance on food safety because of changes in Chinese civil society as a result of these economic reforms and 'opening up'. The case of declining sentiment of GMOs is thus a result of China's quick economic growth in such a short period of time, and the growing pain of a transitioning Chinese society as a legacy of economic and social reforms beginning in the 1980s and continuing into the early 1990s.

4.2 Balancing Economic Growth and Responsibility-Based Legitimacy

The responsibility-based legitimacy idea predicts that social protest could occur when there are perceived breaches in the state's responsibility to fulfill a certain duty. Thus, the responsibility-based legitimacy conception of state and society interaction necessitates close examination of the government reaction to the aforementioned case studies, namely how the state has breached or fulfilled its responsibilities to society. Examining these case studies of genetically modified foods in Chinese society reveals exactly what the public demands from the Chinese state, and Chinese state's reactions reveal how it hopes to reconcile goals of economic growth with the responsibility of

transparency and public health and safety. The Chinese government has grown more embracing of genetically modified food products in order to root out influence of foreign biotechnology firms in its agricultural market and to respond to public skepticism about the transparency of genetically modified food regulations.

In the case of the Golden Rice trials, the Chinese Ministry of Agriculture dismissed three public officials in response to widespread outrage about the means by which the Golden Rice study was conducted. This has proven to be a remarkable hindrance to the continuation of commercializing Golden Rice in China. Given that the experiment involved the nutrition of children, the trials and following scandal about how they were conducted raised questions of family values in China in direct contrast to the value of scientific knowledge for economic growth. The government, in its willingness to dismiss officials over the study, communicated clearly the extent to which it was responsive to the public's outrage in the Golden Rice matter. In the central government's response to public outrage, the government took action to reassure the public that it continued to be a moral and responsible governing body with direct consequences to oversight in large institutions such as the Ministry of Agriculture.

The cautiousness with which the Chinese government is moving forward with increased investment in biotechnology especially involves courting public opinion, a reflection of the government's awareness of public opinion regarding genetically modified foods. ChemChina, a state-owned biotechnology enterprise, has bought Syngenta, a leading Swiss biotechnology firm that specializes in pesticide-resistant plants. Media speculation indicates that this deal was an attempt by the central government to increase public trust if a Chinese company were to provide GM seed varieties.[28]

The central government has openly communicated a desire to re-educate the public on the facts surrounding genetically modified technology in order to quell fears about their safety. State Council Information Office (SCIO) spokesman Han Jun spoke in detail about how China hopes to progress with agricultural biotechnology, admitting that policy makers around the world face regulating issues of science and technology: "Those who are not actually doing the research, like us, may only know a little bit about it and will have to rely on scientific articles to acquire more knowledge of it."[29] With regards to genetically

28 Charlie Campbell, "U.S. Approval of Syngenta Deal Brings GMO Food a Step Closer to China," *Time Magazine,* Aug 23 2016, accessed April 19, 2017, http://time.com/4462394/syngenta-chemchina-gmo-foods/.

29 "SCIO Briefing on Agricultural Modernization on 2015-02-04," State Council Information Office, February 4, 2015, accessed December 5, 2016, http://english.agri.gov.cn/hottopics/cpc/201502/t20150204_24960.htm.

modified crops and foods especially, technology often becomes a social issue. In this statement, the SCIO draws a clear distinction between the role of the state and the role of science as independent from each other in motivation. It also highlights the role that science must play in creating a regulatory framework that keeps the public safe. In this briefing, the SCIO communicates to the public and foreign media that the state is proceeding with greater investments in biotechnology, a move with great potential. However, it makes sure to communicate in parallel reassurance towards the same audience that the state aims to do so with caution and with an awareness that the public has serious misgivings about the risks associated with genetically modified crops.

In addition, the No. 1 Central Government Document released in 2015 regarding China's plans for increased investment in biotechnology carefully communicates its intention to reassure the public about the safety of genetically modified crops.[30] The way in which the SCIO has communicated the stipulations of the No. 1 Central Document is to frame the issue of genetically modified crops as both a scientific and social issue, and appeals to the scientific community as a group to rely on in creating policy that regulates the safety of genetically modified foods, even as the government increases its investment in agricultural biotechnology. The No. 1 Central Document also asserts an effort to "lift the veil" on GM technology in order to quell public sentiment. This displays the government re-taking its responsibility-based legitimation, and clearly it has accounted for public opinion in creating a biotechnology strategy in coming years. In addition to elements of education and public awareness as a matter of government responsibility in the No. 1 Central Document, President Xi Jinping has also appealed to a sense of nationalism in order to regain responsibility-based legitimacy in the realm of genetically modified foods. He said in a 2013 speech to a Chinese farming organization that he intended to increase funding in biotechnology in order not to "yield ground to foreign firms."[31] The SCIO briefing aforementioned also discusses the need to not let foreign firms that are dominating China's agricultural market win. Indeed, in the 2014-2015 fiscal year, China imported more than 70 million tons of genetically modified soybeans from the US.[32] The Chinese state has decided to utilize public awareness, nationalism, and acquisitions of foreign companies as ways to reassure public worry about the uncertainties of genetically modified food.

30 Lu and Chen, "Chinese Public's Risk Perceptions of Genetically Modified Food," 112.

31 "Gene-policy Transfer: China May Relax its Almost Total Ban on Growing GM Food." *The Economist*, April 3, 2016, accessed December 5, 2016, https://www.economist.com/news/china/21697272-china-may-relax-its-almost-total-ban-growing-gm-food-gene-policy-transfer.

32 Karen Braun, "China Imports Will Keep U.S. Soybean Market on Its Toes: Braun," *Reuters*, September 9, 2016, accessed December 5, 2016, http://www.reuters.com/article/us-china-soybeans-braun/china-imports-will-keep-u-s-soybean-market-on-its-toes-braun-idUSKCN11F2GT.

The way in which the central government has responded to regulating genetically modified crops, and the way in which it is moving forward with pursuing biotechnology demonstrates its awareness of the linkage between responsibility to society and its legitimacy. With its policies in the past, especially with poorly enforced and inconsistent seed laws that allowed loopholes in the Nestle lawsuit, the Chinese central government suffered a great blow to its responsibility-based legitimacy in that governance had not yet adequately dealt with the uncertainties of a new technology. However, the way in which President Xi Jinping is communicating China's new biotechnology strategy indicates that the Chinese central government has acknowledged its awareness of its responsibility for protecting the well-being of its people. On another end, though, is the incentive of economic growth. Thus, the Chinese state has been in a delicate position regarding genetically modified crops, since they present a commercial opportunity but also present a huge blow to public perception of the state's responsibility. In its biotechnology strategy, the government moves forward cautiously, courting public opinion and seeking to re-educate it. The way in which the government is moving forward with its biotechnology strategy indicates that it hopes to maintain its responsibility to the well-being of its people.

With the commercialization of the virus-resistant tobacco in 1988, China has proved that it is set to be a world leader in innovation, science, and technology. Its major strides in biotechnology are motivated first by the sensitivity that the Chinese state has undergone in issues of subsistence. The scars of these times remain within the collective memory of society, and influence the extent to which the Chinese central government has considered food security a significant issue. The biotechnology craze that began in the 1980s proved a great strategic opportunity for the Chinese state to feed its people with less crop inputs. Issues of food scarcity and subsistence pose a great threat to Chinese society's well-being even today with the level of economic development that the Chinese economy has achieved. Chinese society today has increased its labor in the manufacturing sector, with less employment in the agricultural sector. This has increased the need for greater production efficiency, and biotechnology presents the central government a strategic opportunity.[33] These changes in the economy have also created and exposed deep rifts in society over the trajectory of the nation. The case of genetically modified crops with the interaction of the Chinese public and state is one such example.

33 Lester Brown, *Who Will Feed China?: Wake-Up Call for a Small Planet* (The Worldwatch Environmental Alert Series. New York: W.W. Norton & Company), 1995.

Public opinion of genetically modified foods in Chinese society has reversed dramatically since the 1990s, when public sentiment surveys revealed that the Chinese public was most enthusiastic about the potential that GMOs presented in terms of economic development. Today, food safety scandals have created disenchantment with the government's involvement in Chinese food sources. This has indicated that Chinese society is not in fact apathetic to the governance and performance of the Chinese state. Instead, Chinese society has lost its faith in the legitimacy of the government in its capacity to regulate food and keep it safe. Instead, the rapid economic development of the 1990s is seen as a "growing pain" to China's modernization.

The government biotechnology strategy has incorporated responsibility-based legitimation in order to restore faith in its society. Several government communications, such as the No. 1 Central Document and Xi Jinping's 2013 speech to rural workers, acknowledge the Chinese state's responsibility to the public. Chinese policy regarding increased investment in biotechnology has been to change public opinion about genetically modified crops, and to keep the negative influence of NGOs at bay. In order to do so the government has acquired foreign firms in hopes of gaining public trust if GM seeds are produced in China, and has also conveyed an intention to launch public awareness campaigns and increased transparency in the information available about genetically modified crops. Before the Chinese government decided to increase its dedication to biotechnology it was largely inconsistent about enforcement and regulation surrounding genetic modification of foods. Since the MOA's approval of licensing of genetically modified rice, the central government has put forward a more united front on its decidedly more enthusiastic stance on genetically modified crops. This indicates that while Chinese society has changed, so has the state. Close examination of the discourse surrounding genetically modified food thus reveals a confluence of interaction between a rapidly transforming society and state.

5. Concluding Remarks

The conclusions and analysis of the case studies in this work thus reveal important findings about the nature of a transforming Chinese state and society. First, emerging non-state actors in civil society have increased their influence over public opinion. This finding adds to the understanding that social and economic reforms in China since 1978 have made profound changes to the actors present within Chinese society. Second, by examining government reactions to genetically modified foods in the Chinese news outlets the government has grown responsive directly to the public, acknowledging its public accountability. This finding means that while society has changed, the

state has also changed in response, affirming the notion that Chinese state and society interact dynamically in the long run. In a more internationalized context this also means that the Chinese state, while conscious of its economic growth relative to the rest of the world, publicly acknowledges its own accountability to Chinese society in pursuing this economic growth and status as an economic superpower. Examining state and society interactions over the GM food debate in China does not only reveal profound changes over time; rather, close examination and research reveal that the structure and nature of Chinese state and society have changed since the emergence of genetically modified foods in consumer markets.

Genetically modified food in Chinese society has the potential to accomplish greater efficiency of agriculture and to free China from presence of foreign biotechnology firms in its seed markets. However, public opinion and widespread belief of the harmful and long-term health effects of genetically modified foods constrain the degree to which the government can move forward. With the four case studies applied to a state-society interactions framework, this research demonstrates that while the Chinese state has grown more open to the potential of biotechnology, rising actors in a rapidly changing Chinese society have played a role in shifting public opinion against GM foods.

In examining cases of the role of genetically modified foods in Chinese society, including cases in the Chinese legal system, the increased influence of NGOs and the media, and China's dependence on GM soybean imports, it is clear that Chinese society is changing. Examining state-society relations in China can expose the weak points, or "growing pains" present in a transitioning society. Chinese consumers are given the space to react to new changes in their lives—such as exposure to the products of international markets—on new platforms of social media. Additionally, non-governmental actors are able to influence society and play a role in public opinion and how society has demanded accountability from the government regarding genetically modified foods. From the perspective of the government, the Chinese state has been placed in a position where it must treat the commercial viability of biotechnology and GMOs with extreme caution, so as not to risk its previously lost legitimacy.

The case of genetically modified foods has presented such a case in which the interactions between state and society have changed since their advent in the early 1990s. This case is more generally applicable to the cycle of new technologies. Increased modernization since the 1980s and 1990s has brought about societal resistance—particularly in biotechnology. This is understandable since the risks of new technologies such as genetically modified foods are not fully understood. This also creates wider uncertainties with the state, since even at the highest levels of government policymakers

remain uncertain about to what extent they must balance scientific consensus and public opinion in their policies regulating new technologies. In the case of the European Union and regulation of GMOs, policymakers have proven particularly sensitive to public opinion, since their re-election depends on it.[34] Elements of this sensitivity to public opinion are becoming more present in the China model of regulation, since Chinese society has made the central government more aware and conscious of its responsibility to public safety in its governance.

The case of genetically modified organisms in China, accounting for factors such as risk perception, trust in the government, and the government's attempts to regain legitimacy, is simply one case in which the gaps between the scientific community, the public, and the government need to be bridged. These three actors in a nation-state have their own stake in new issues facing the 21st century, such as addressing issues of climate change, renewable energy, food scarcity, and other resource scarcity. Thus, the need for increased communication and understanding of these three elements in society will only grow in coming years, not only in China, but also in other developed countries. As a developing nation, China displays a particular need to bridge these gaps in order to regain the state's legitimacy in the eyes of its society and its scientific community as it hopes to advance in coming years. As China will move forward with investments in biotechnology and its attempt of food self-sufficiency, the findings of this research clearly demonstrate that in pursuing new innovation strategies, the Chinese government will take public opinion into account in its decision-making. As China becomes a global leader, a deep and potent understanding of the relationship and interactions between science, technology, and society will facilitate China's rise as an economic and social powerhouse, and world leader in agricultural biotechnology.

The advancement of new technology necessitates regulation that balances advancement with safety and also public confidence in the safety of such a technology. State-society interactions on scientific issues illustrate a new and increasingly common interaction in governments around the world, not just in China's authoritarian regime. This research highlights these interactions utilizing existing frameworks of state and societal interaction, but further research could build upon this work by establishing a framework specifically taking into account state-society interactions in issues of new science and technology.

34 Shane H. Morris and Charles Spillane, "GM Directive Dleficiencies in the European Union," *European Molecular Biology Organization reports* 6 (2008): 501.