PUBLIC PERCEPTIONS OF "GENETICALLY MODIFIED" FOOD IN THE UNITED STATES: THE ROLES OF KNOWLEDGE, RISK, AND TRUST

by

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PREVIEW

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Public perceptions of "genetically modified" food In the United States: The roles of knowledge, risk, and trust

Thesis directed by Assistant Professor Amanda Carrico

Plants and animals bred using DNA from a separate organism – a process called transgenesis that uses recombinant DNA technology – are referred to as “genetically modified” (GM) throughout the world. Certain GM plants have been widely used by farmers and have demonstrated a variety of benefits. However, concerns over the safety of GM foods have led to restrictions and bans of GM foods throughout the world. Moreover, a majority of American residents think that GM foods are unsafe to eat. This study investigates the gap between the views of the American public with mainstream scientific consensus. I propose a model of public perception of GM foods based on how knowledgeable a person is, their risk perceptions, and the amount of trust they have in different actors in the GM debate. Results suggest that perceptions of risk shape views towards and purchasing behavior of GM foods, over and above other measured factors.

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Introduction

Background

In 2017 roughly 800 million people suffered from hunger and over 200 million children under five years of age were afflicted with stunting or wasting, the vast majority of whom live in poorer countries in Asia and Africa (Food Security Information Network, 2018; UNICEF / WHO / World Bank, 2018). Available food resources are likely to be further strained in the future. The global population is expected to increase to over 11 billion by the end of the century (United Nations, Department of Economic and Social Affairs, Population Division, 2017). Moreover, the negative impacts of climate change on agriculture are expected to occur predominantly in the developing world, potentially adding an additional 80-90 million to the number of hungry and malnourished by century's end (IPCC, 2001, Chapter 19 Box 19-3). Finally, as many countries have developed and grown a middle class, the additional demand for meat and other animal products has put further stress on food systems and necessitated both putting additional land into agricultural production and increased the price of grain, further contributing to food insecurity (Rosegrant, 2008; Timmer, 2008). As a result of these processes the demand for food globally will increase and, given the scale of the increase, it is likely farmers will be called upon to increase yields on currently planted acres as well as farm more acreage.

Throughout time, in order to increase yields, farmers have incorporated technological advances into their production strategies, often unbeknownst to the general public. In the last three decades, however, consumers in the United States and throughout the world have become increasingly interested in agricultural and plant breeding processes. One type of plant breeding – referred to hereafter as transgenesis – has captured the attention of consumers, private companies, and government regulators more than any other. Recombinant DNA (rDNA) technology uses enzymes to combine DNA sequences; these sequences can then be transferred into a host cell in

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order to express desirable characteristics (Pray, 2008). Transgenesis, which utilizes rDNA technology, is known more commonly as genetic engineering (GE) or genetic modification (GM) and has been used since the 1970s (Pray, 2008). Crops bred using GM technology have demonstrated increases in crop yields and reductions in pesticide use compared to conventional crops (Finger et al., 2011; Klumper and Qaim, 2014). Yet, the overall impact of GM crops has been relatively limited compared to what early proponents expected, due in part to public concerns over safety (Herring and Paarlberg, 2016). In the United States nearly forty percent of consumers think that GM foods are worse for their health than non-GM foods (Pew Research Center, 2016). Asked another way, just thirty-seven percent agree that GM foods are safe to eat (Pew Research Center, 2015). The negative public response to crops bred via transgenesis (i.e. GM, genetically modified, GMO, etc.) has limited the number and types of these potentially beneficial crops that have been grown throughout the world (Herring and Paarlberg, 2016). The lack of uptake has been driven either via private companies not wanting to use GM crops for fear of public outcry - as in the United States – or lack of government approval (e.g. much of the European Union, and many countries in Africa) (Herring and Paarlberg, 2016). Because attitudes towards GM foods have been used as a justification for policies or practices restricting their use, it is important to better understand the attitudes the public holds towards this technology and other methods of plant breeding. Indeed, since the introduction of this technology members of the agricultural industry, policymakers, and scientists have surveyed the public in order to better understand individuals' reactions. This study continues in that tradition and seeks to add to the conversation by gathering public preferences for a wide variety of policy outcomes as well as understanding how knowledge of GM regulation and risk perceptions of GM foods influence those policy preferences.

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Sociotechnical History of Genetic Modification

Farmers have used selective breeding for centuries as a means to increase agricultural yields. It wasn't until the late 19th and early 20th century that Gregor Mendel's work on plant hybridization was appreciated and plant breeding was taken up on a large scale by governments and commercial entities (Kingsbury, 2009). Since then there have been rapid technological advances in the fields of plant and animal breeding as well as wide scale adoption of plant varieties produced in the last 100 years (Herring and Paarlberg, 2016). These advances have been driven by the desire to produce crop varieties that exhibit traits useful to farmers (e.g. resistance to pests, larger fruits/seeds) and/or consumers (e.g. more uniform end product, better taste). Advances in the fields of plant genetics and agricultural biotechnology went largely unnoticed and were even applauded by the general public in the United States until the 1990s (Mohorcich, 2018). One particular method of plant breeding discovered in 1973 and dubbed transgenesis, a process that involves the direct and intentional transfer of genetic material from one organism into another, was cause for controversy and public concern (Losey et al., 1999; Kuntz 2014; Mintz, 2017).

Since the 1980s the term "genetic modification" or "genetic engineering" or "GMO" has typically only applied, in the public mind as well as in legal definitions, to plant and animal varieties developed via rDNA technology and that involve the transfer of genetic information between organisms (Mohorcich, 2018; 7 C.F.R. § 340.1). At the time of their commercialization in the late 1980s, two thirds of Americans demonstrated approval or ambivalence towards genetically engineered products (Ezzell, 1987; Finucane and Holup, 2005; Mintz, 2017). In the 1990s, however, a study linking a transgenic variety of maize with harm to Monarch butterfly larvae ignited public outcry over "GMOs" (Losey et al., 1999; Kuntz, 2014; Mintz, 2017). Though the negative effects of the GM maize on Monarch butterflies were quickly thereafter shown to be

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