Cross-National Newspaper Coverage of Genetically Modified Foods
A Community Structure Approach

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May 4, 2012

Abstract

A cross-national survey using the "community structure approach" examined the relationship between national characteristics and national newspaper coverage of favorable versus unfavorable towards genetically modified foods. The NewsBank database was searched for articles of 250 words or more in a cross-national sample of 13 newspapers over an eight-year time period, from July 1, 2003, to July 31, 2011, yielding 282 articles. Articles were coded for "prominence" and "direction" (favorable, unfavorable, or balanced/neutral), which when combined produced a single "media vector" score for each newspaper.

Media vectors for different cities ranged from .2327 to -.4436. Eight of the 13 nations demonstrated favorable coverage of genetically modified food. The other five displayed unfavorable coverage of the issue. Pearson correlations revealed that national characteristics classified under the "Violated Buffer Hypothesis", "Vulnerability Hypothesis" and "Stakeholder Hypothesis" had strong associations with unfavorable coverage of genetically modified food. It was hypothesized that a higher average happiness score would correlate with unfavorable coverage of genetically modified foods. Because issues of hunger do not directly affect those with privilege, or those who are "happy", they would likely see the potential risks outweighing the benefits. The results showed that higher average happiness scores in nations correlated with less favorable media coverage of genetically modified food ($r = -.635$, $p = .01$), supporting the hypothesis. GDP added from agriculture, fertility rates and infant mortality rates correlated with more favorable media coverage of genetically modified foods ($r = .519$, $p = .042$; $r = .493$, $p = .043$; $r = .485$, $p = .046$, respectively). It was hypothesized that GDP added from agriculture would correlate with positive coverage of genetically modified foods. It is reasonable to believe that in an area where agriculture is important, genetically modified foods would be accepted

because of the potential profits to be made form it. Fertility rates and infant mortality rates are both indicators of vulnerable populations. These populations are likely to be affected by malnutrition and hunger and would likely support genetically modified food as a solution to this problem. A regression analysis that linked national characteristics and media vectors determined percent agricultural land in a nation to be the most significant variable, accounting for 64.1% of the variance. Another significant variable was Average Happiness Score, which accounted for 23.0% of the variance. Together, these two variables proved to be very significant, counting for 87.1% of the variance. Overall, each of the main umbrella hypotheses, violated buffer, vulnerability and stakeholder, were strongly supported. This shows that genetically modified food is an important issue that is a major debate in global media. Media coverage of genetically modified food is highly influenced by national characteristics, further supporting the community structure approach.

Cross-National Newspaper Coverage of Genetically Modified Foods:
A Community Structure Approach

While the issue of genetically modified foods is a relatively new debate, it is one that

has caused tremendous controversy in its short history. The topic of genetically modified foods

affects almost everyone – scientists, governments, non-governmental organizations, farmers and

parents alike. Because foods are internationally traded goods and a necessity for human survival,

the debate has grown into a major global issue.

This topic has been framed in the media in contrasting points of view. Framing is the

organization of events into a coherent story, depicting one perspective as more favorable or

reasonable than others, (D'Angelo, 2002, pp. 870-871). The topic of genetically modified foods

in the media can be divided into two frames. The first frame champions genetically modified

foods because they have many advantages for society, while the second frame warns that

genetically modified food can be detrimental to society.

The first frame suggests that genetically modified foods are beneficial to society,

because they produce more food, feeding more people and require less pesticide use, causing less

damage to the environment. Those who support genetically modified foods would argue that the

production of these foods benefits both the consumer and the producer. The consumer reaps the

benefits of more food for less money, while the producer is able to sell more products.

 Furthermore, it has been proposed that genetically modified foods may provide aid in the fight

against world hunger, (Genetically modified food benefits, 2006, p. 65).

The second frame proposes that genetically modified foods are detrimental to society,

because of the potential risks and side effects of their production. Supporters of this frame

would argue that the long-term effects of human consumption of genetically modified foods are

still unknown and that they have the potential to adversely affect the health of those consuming

them. Additionally, it has been suggested that genetically modified food crops could spread to

nearby cropland and plants, disrupting the natural ecosystem, (Genetically modified food

benefits, 2006, p. 65).

Since the mid-1990s, there has been a drastic rise in total cropland planted with

genetically modified foods worldwide. This staggering increase is reflected in media, resulting

in a remarkable amount of coverage being given to the issue, especially in global newspapers.

 Even in today's increasingly technological society, newspapers remain influential for a number

of reasons. Newspapers are agenda setters, influencing many other media channels such as radio,

television, and Internet, and stimulate discussion of community issues. Additionally, newspapers

are read by influentials, such as politicians, economic leaders, and the well-educated. These

influentials have the power to affect public opinion and engender debate of certain issues

(Pollock, 2007, pp. 5-6). Because of the high level of influence of newspapers, this study will

focus on newspaper coverage of the genetically modified foods debate.

This study will analyze the impact of society on media coverage of genetically

modified foods using the community structure approach. This approach explains the way

demographics of a city or nation affect media coverage of controversial issues, (Pollock, 2007, p.

23). This perspective was first conceived by Robert Park of the University of Chicago (1922),

later expanded upon by Tichenor, Donahue and Olien's studies of community structural

pluralism which suggests that the more diverse a city, the more diverse news coverage of a topic

will be (1973, 1980). The community structure approach was further developed by McLeod and

Hertog (1992, 1999), Demers and Viswanath (1999), and Hindman (1999). Pollock and

colleagues (1977, 1978, 2004, 2007) have further developed this approach, using nationwide,

multicity studies. These studies have shown strong correlations between city characteristics and

newspaper coverage of certain issues. The community structure approach is a paradigm shift in communication theories. The development of this theory challenged the prevalent assumption that media affects public opinion (Nah & Armstrong, 2011). Contrasting with the widespread postulation that media affects society, the community structure approach takes the opposite standpoint, focusing on society's effects on the media (Pollock, 2011). This study of news coverage of genetically modified foods will explore the way the topic is framed in relation to varying national characteristics utilizing the community structure approach.

This study will focus on two main research questions to examine cross-national coverage of genetically modified foods:

RQ 1: How much variation is there in cross-national coverage of genetically modified foods?

RQ 2: What national characteristics are most associated with that variation?

Many national characteristics can be associated with newspaper coverage of genetically modified foods. For example, it is reasonable to believe that the higher the literacy rate in a nation, the less favorable media coverage of genetically modified foods. Higher literacy rates indicate more educated populations leading to more knowledge of the potential health risks of genetically modified foods and less favorable public opinions of the topic. By contrast, the greater percentage below the poverty level in a nation, the more favorable coverage of genetically modified foods. Because populations with high poverty levels are likely to reap the benefits of genetically modified foods, it is reasonable to believe that newspaper coverage in these areas will reflect the communities' best interests. These correlations between national characteristics and newspaper coverage of genetically modified foods, along with many others will be explored in this study.

Literature Review

Because genetically modified foods is such an vital and pertinent topic, it has been the subject of a vast number of studies by scholars from numerous fields. While considerable research has been done in the fields of biology and agriculture, applied science and technology, and health science, the field of communication studies is surprisingly lacking in studies on genetically modified food. This is reflected in the small number of articles found in a literature search of the topic in communication studies databases when compared with those of databases of other fields. A search of the terms "genetically modified food*," "genetically engineered food*," "genetically altered food*," "genetically modified organism*," "genetically engineered organism*," "genetically altered organism*," "genetically modified crop*," "genetically engineered crop*," "genetically altered crop*," "biotech food*," and "biotech crop*" in the Communication and Mass Media Complete database yielded 55 peer-reviewed journal articles. Of these articles, very few were relevant as most focused mostly on debates and controversy over genetically modified food regulations. Furthermore, only a few articles were found when the search term "media" was added, resulting in 16 total articles.

Of the 16 articles, one article, "Genetically modified food in the news: media representations of the GM debate in the UK" focused on representation of various stakeholders in newspaper coverage of genetically modified foods in the year following the GM nation debate. The study mainly analyzed the British public, the British government, the science of GM, and the biotechnology companies as the major stakeholders. It found that the British public was mainly represented as uniformly opposed to GM crops, positioning the government as undemocratic in their policy making decisions. It also found that media highly contested the science of GM farming. Overall, the study found that newspaper coverage of genetically

modified foods in the UK represented the debate as "a battleground for competing interests" (Augoustinos, Crabb, & Shepherd, 2010).

Another article, "'We Begin Tonight With Fruits and Vegetables' Genetically Modified Food on the Evening News 1980-2003" discusses framing of the genetically modified food debate in television news programs in the United States. The study focuses on the main news channels in U.S. television - ABC, CBS and NBC between the years of 1980 and 2003. These years include the introduction of genetically modified foods as well as the surrounding debates main years of controversy. The study analyzes quality, placement, length, and spokespersons, finding that there was minimal coverage of the debate and minimal consistency even within networks (Nucci & Kubey, 2007).

A third study, "Food Science: Media Coverage of Genetically Modified Foods in the US and France, 1998-2002" analyzed media framing of genetically modified foods in the US and France. While both US and French newspapers discussed safety, economics, risks and labeling issues, US media focused more on regulation issues and French media focused on food quality and regulatory policies to protect health. While frames overlapped, US and French newspapers ephasized different content. For example, "Lableing was an official and reguatory issue in the US, while French newspapers viewed regulation as international trade relations" (Murphy & Vilceanu, 2005).

Lastly, only one article was found regarding specifically media coverage on genetically modified foods in the United States. Published in Argentina's *Ecos de la Comunicación*, "Newspaper Coverage of Genetically Modified Foods in the United States: A Community Structure Approach," found that higher proportions of vulnerable populations strongly correlated with more favorable newspaper coverage in major metropolitan areas between the years 2000

and 2004 (Pollock, Maltese-Nehrbass, Corbin, & Fascanella, 2010). While this article directly dealt with newspaper coverage of genetically modified foods, it is important to examine coverage of genetically modified foods on an international level, since it is such a global issue.

In contrast with the limited number of relevant research articles in the communication studies field, a search of other disciplines produced a substantial number of relevant research articles. A search in the field of nursing/health science produced a large number of results. The Cumulative Index to Nursing and Allied Health Literature database yielded 103 peer-reviewed journal articles relevant to the topic. In an article titled "Say No to GMOs," Smith (2011) argued that there are no benefits to genetically modified organisms, only countless health risks, such as toxins and allergens being passed to humans. Moreover, she contends that crop yields have not significantly increased in the past twenty years, nor has pesticide use decreased (Smith, 2011). Additionally, Kuzma, Najmaie, and Larson (2009) reviewed the strengths and weaknesses of genetically engineered organisms by analyzing legal, ethical, and risk analysis and policy science viewpoints. Moreover, Horlick-Jones, Walls, and Kitzinger (2007) examined understanding and discussing issues about genetically modified foods and crops.

Additionally, searching the Applied Science & Technology database produced an even more substantial number of results. Using the search terms "genetically modified food*," "genetically engineered food*," "genetically altered food*," "genetically modified organism*," "genetically engineered organism*," "genetically altered organism*," "genetically modified crop*," "genetically engineered crop*," "genetically altered crop*," "biotech food*," and "biotech crop*," in Applied Science & Technology, 522 relevant peer-reviewed journal articles were found. In an article titled "Biotech bananas combat bacteria," Turley (2010) examined engineered banana plants that resist disease by introducing genes from green pepper plants,

which have proteins that rapidly kill any cells that come into contact with disease bacteria. In addition, O'Driscoll (2010) discussed the global food crisis and the potential benefits of genetically modified crops, claiming that genetically modified crops and other types of agricultural technologies have the potential to alleviate food shortages and increase productivity

A search of the biology and agriculture field yielded a large quantity of results, more than any other field. Using the search terms "genetically modified food*," "genetically engineered food*," "genetically altered food*," "genetically modified organism*," "genetically engineered organism*," "genetically altered organism*," "genetically modified crop*," "genetically engineered crop*," "genetically altered crop*," "biotech food*," and "biotech crop*" in the Biological & Agricultural Index database yielded 3,837 peer-reviewed journal articles. Knox et al. (2012) examined the impact genetically modified crops can have on improving herbicide and insecticide usage, and, therefore, improving the overall quality of the environment. Additionally, Seth (2012) analyzed the role of genetically engineered plants in environment cleanup.

The field of communication studies has not given ample attention to the topic of genetically modified food. Compared to other fields, such as nursing/health science, applied science and technology, and biology and agriculture, the communication studies field is far behind. This study will attempt to bridge the gap between the communication studies field and the aforementioned fields in regards to the topic of genetically modified food.

Hypotheses

Using the community structure approach, 34 individual hypotheses can be applied to the international issue of genetically modified foods. These hypotheses can be classified into three umbrella hypotheses: violated buffer, vulnerability, and stakeholder.

Privilege: "The Violated Buffer Hypothesis"

Pollock's "violated buffer hypothesis" proposes that the more privileged groups in a community, the more unfavorable coverage of biological threats or threats to a cherished way of life. Privileged groups can be defined as those with college educations, those with professional or technical occupations, or those who have family incomes greater than $100,000. These groups can be labeled as "buffered" because they are often protected from economic uncertainty. When these privileged groups within a community experience a significant threat, a "violated buffer" pattern occurs. Numerous studies have shown a link between high proportions of privileged groups within a community and unfavorable coverage of issues that are deemed biological threats or threats to a cherished way of life. For example, a study utilizing the community structure approach on media coverage of women in combat positions found coverage of the issue was much more unfavorable in cities with high proportions of families with incomes of $100,000 or more (Pollock, Mink, et. al, 2001). This study shows a strong correlation between privileged groups and negative reporting on an issue, which may be considered a threat to a cherished way of life. Additionally, studies on Magic Johnson's HIV announcement (Pollock, 2007, p. 218), gun control since the Columbine incident (Pollock, 2007, p. 173) and tobacco use among children, (Pollock, 2007, p. 103) found similar correlations between privileged groups and coverage of issues that are deemed biological threats or threats to a cherished way of life. Because the issue of genetically modified foods is viewed by many as a threat to a cherished way of life, previous studies and conventional wisdom suggest that a violated buffer pattern will be found when analyzing coverage of genetically modified foods. Therefore, it is likely that in areas with higher proportions of privileged groups, coverage of genetically modified foods is likely to be unfavorable. Accordingly:

H1: *The higher the GDP in a country, the less favorable media coverage of genetically modified food* (CIA World Factbook, 2011).

H2: *The higher the GDP per capita in a country, the less favorable media coverage of genetically modified food* (CIA World Factbook, 2011).

H3*: The higher the literacy rate in a country, the less favorable media coverage of genetically modified food* (CIA World Factbook, 2011).

H4: *The higher a country's average happiness score on the World Database of Happiness, the less favorable media coverage of genetically modified food* (World Database of Happiness, 2011).

Health care access. Measures of health care access in countries can be a major indicator of either favorable or unfavorable media coverage given to certain topics in those countries. Health care access can be measured by different factors, including number of physicians per 100,000 citizens, percent municipal spending on health care, and number of hospital beds per 100,000 citizens. Previous community structure approach studies have demonstrated a positive correlation between health care access and media coverage of health related topics. Studies on media coverage of both physician-assisted suicide as well as embryonic stem cell research have shown a positive relationship between healthcare access, specifically physicians per 100,000 residents, and favorable media coverage (Pollock, 2007, p. 89). Moreover, a study on the media coverage of the banning of tobacco ads geared towards children in the Master Settlement Agreement also found a link between higher rates of healthcare access and favorable media coverage (Pollock, 2007, p. 173). Therefore, it is reasonable to believe an association exists between high rates of health care access in countries and considerable unfavorable media coverage of genetically modified foods:

H5: *The greater the number of physicians per 100,000 people in a country, the more favorable media coverage of genetically modified foods* (United Nations Statistics Division, 2011).

 H6: *The greater the number of hospital beds per 100,000 people in a country, the more favorable media coverage of genetically modified foods* (United Nations Statistics Division, 2011).

The Vulnerability Hypothesis

Pollock's vulnerability hypothesis proposes that the greater the number of vulnerable populations in an area, the more favorable the coverage will be of critical issues that benefit the vulnerable populations (Pollock, 2001, p. 137). Vulnerable populations include those under the poverty level, unemployed citizens, those who live in areas with high crime levels, or those who live under other conditions that put them at a disadvantage. Numerous studies have shown a link between vulnerable populations and favorable coverage of issues that affect them. For example, a study on nationwide coverage of capital punishment found that in areas with vulnerable populations, unfavorable coverage of the death penalty was more likely. This is most likely because those populations are more vulnerable to capital punishment (Pollock, 2007, p. 142). Another study on coverage of the Patient's Bill of Rights found that the higher the proportion of those under the poverty level in a city, the more likely news coverage was to support the Patient's Bill of Rights (Pollock, 2007, p.155). This is probably because those under the poverty level, who are not likely to have medical insurance would benefit most from the Patient's Bill of Rights. A recent study which analyzed public affairs blogs in 232 US cities produced results which supported the vulnerability hypothesis. The study found a correlation between measures of "community stress" and the presence of public affairs blogs, showing that media reflects the

interests of vulnerable populations (Watson & Riffe, 2011). A study on media coverage of

genetically modified food found that the higher the proportion of citizens below the poverty level

in a city or the higher the unemployment rate in a city, the more favorable media coverage of

genetically modified food, (Pollock, et al., 2010). Since genetically modified food can be

produced in larger quantities and feed more people for less money, it is reasonable to believe that

those populations who are in need of food would support this issue. Because production of

genetically modified food benefits vulnerable populations, it is reasonable to believe that areas

with higher proportions of vulnerable populations can be associated with favorable media

coverage of genetically modified food. Therefore:

> **H7:** *The greater the percentage of undernourished, the more favorable media*
>
> *coverage of genetically modified food* (World Desk Reference, 2004).
>
> **H8:** *The greater the percent below poverty level, the more favorable media coverage*
>
> *of genetically modified food* (World Bank, 2011).
>
> **H9:** *The higher a nation's infant mortality rate, the more favorable media coverage of*
>
> *genetically modified food* (United Nations Statistics Division, 2011).
>
> **H10:** *The higher the fertility rate, the more favorable media coverage of genetically*
>
> *modified food* (CIA Factbook, 2010).
>
> **H11:** *The higher the percentage of population under the age of 14, the more favorable*
>
> *media coverage of genetically modified food* (World Bank, 2011).
>
> **H12:** *The higher a nation's Gini inequality index, the less likely coverage is to*
>
> *emphasize government action against human trafficking* (CIA World Factbook, 2011).

The Stakeholder Hypothesis

Pollock's stakeholder hypothesis suggests that in areas with a large number of

stakeholders, media coverage is more likely to emphasize favorable coverage of issues that benefit those stakeholders (Pollock, 2007, p.171). Stakeholders include those who are directly affected by the critical issue being studied. Studies on the community structure approach have found a strong correlation between areas with high proportions of stakeholders and media coverage emphasizing support for issues benefiting those stakeholders. For example, a study of Magic Johnson's HIV announcement found that in areas with high proportions of people who were psychologically "involved" with Magic Johnson, media coverage was favorable (Pollock, 2007, p.175). Additionally, a study on gun control found that in areas with high proportions of parents with young children, media coverage was more likely to report favorably on gun control (Pollock, 2007, p.175). In both of these studies, newspaper coverage reflected the interest of the stakeholder groups, showing that stakeholders in an issue have a significant effect on the newspaper coverage in an area. Based on these studies, it is reasonable to assume that stakeholders in the issue of genetically modified food will have a great effect on newspaper coverage of the issue.

       Energy production/consumption and infrastructure. The stakeholder hypothesis can also include populations that produce or consume energy. These stakeholder populations have been linked to aims to protect the current situation in many studies. A study on coverage of Isreal's response to the July 2006 Hezbollah attack found a correlation between the amount of energy produced and consumed by a country and media representation of Isreal's response as a threat to the predictable way of life (Pollock, 2007). Other cross-national studies, including studies on Muslim immigration and human trafficking have further supported this hypothesis (Pollock, 2007). To populations that produce or consume large amounts of energy, their traditional way of life is being threatened by the emergence of genetically modified foods. In

addition, when analyzing the issue of genetically modified foods, it is important to remember a nation's infrastructure. Nations with stronger infrastructures, such as roadways and railways which facilitate the production of resources, would logically have a similar desire to preserve the status quo. Therefore:

H13: *The more oil consumed by a country, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H14: *The more oil produced and/or held by a country, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H15: *The more natural gas consumed by a country, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H16: *The more natural gas produced and/or held by a country, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H17: *The more electricity consumed by a country, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H18: *The more electricity produced and/or held by a country, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H19: *The more coal consumed by a country, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H20: *The more coal produced and/or held by a country, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H21: *The larger the total length of a country's road network, the less favorable coverage of genetically modified foods* (CIA World Factbook, 2011).

H22: *The larger a country's industrial production growth rate, the less favorable*

coverage of genetically modified foods (CIA World Factbook, 2011).

Level of press freedom. A nation's ability to freely express itself within the press plays an important role in how media will frame critical issues. Pippa Norris found that media systems must meet certain conditions in order to positively affect democratic development(2004). According to Norris, "The analyses substantiate that the normatively postulated positive relationship between democratic government and human development and media systems is manifest only in countries that meet both conditions of an independent free press and open pluralistic access for all citizens" (Norris, 2004, p. 13).   Additionally, a study by Pollock, D'Angelo, et al. (2010) found a correlation between higher levels of press freedom in a nation and the greater media emphasis on government support to fight the AIDS epidemic in Africa. Considering the aforementioned research, it would be reasonable to believe that higher levels of press freedom would correlate with unfavorable coverage of genetically modified foods. Therefore:

> **H23:** *The higher a nation's rank according to the Freedom of the Press Report, the less favorable coverage of genetically modified foods* (Freedom of the Press, 2011).

> **H24:** *The higher a nation's daily newspapers per 100,000, the less favorable coverage of genetically modified foods* (Freedom of the Press, 2011).

> **H25:** *The higher the percentage of a nation's population covered by a mobile phone network, the less favorable coverage of genetically modified foods* (Freedom of the Press, 2011).

> **H26:** *The greater number of journalists imprisoned in a nation, the less favorable coverage of genetically modified foods* (Human Development Report, 2010).

> **Agricultural and Rural Development.** Because genetically modified foods are

engineered to withstand disease, crop producers are able to lower costs and lessen product loss by growing them. Therefore, it is reasonable to believe that crop producers will support the emergence of genetically modified foods. In a previous study by Pollock, O'Grady, Hiller, Pannia, & Lutkenhouse (2004) on genetically modified foods, farm owners who have sizable farms and produce a substantial amount of crops are likely to employ new, beneficial technologies, such as genetically modified foods. It is reasonable to assume, based on the aforementioned reasons, that in areas where agriculture is prevalent, media coverage of the issue is likely to be framed favorably, reflecting the interests of the crop producers. Accordingly, in nations of agricultural importance, it is likely to expect:

> **H27:** *The greater the percentage of agricultural land in a nation, the more favorable the media coverage of genetically modified foods* (World Bank, 2011).

> **H28:** *The greater the value added to a nation's GDP from agriculture, the more favorable the media coverage of genetically modified foods* (World Bank, 2011).

> **H29:** *The greater the crop production index score in a nation, the more favorable the media coverage of genetically modified foods* (World Bank, 2011).

> **H30:** *The greater the food production index in a nation, the more favorable the media coverage of genetically modified foods* (World Bank, 2011).

> **H31:** *The greater the percentage of permanent cropland in a nation, the more favorable the media coverage of genetically modified foods* (World Bank, 2011).

> **H32:** *The greater the percentage of rural population in a nation, the more favorable the media coverage of genetically modified foods* (World Bank, 2011).

Organic Agriculture. Some people believe that genetically modified foods pose a risk of spreading to other cropland and disrupting that natural ecosystem. This is a major concern for

organic farmers and those who buy organic food, because they fear that genetically modified crops will spread into organic cropland, contaminating the. Therefore, many organic farmers and those who live in areas with organic farmland are opposed to genetically modified foods. Based on the stakeholder hypothesis, it can be assumed that media coverage of geneticially modified foods in areas with high proportions of organic food producers and consumers will reflect the interest of those stakeholders. Therefore:

> **H33:** *The greater the percentage of agricultural land that is organic in a nation, the less favorable the media coverage of genetically modified foods* (The World of Organic Agriculture, 2012).

> **H34:** *The greater the number of producers of organic food crops in a nation, the more favorable the media coverage of genetically modified foods* (The World of Organic Agriculture, 2012).

Methodology

In order to analyze the issue of genetically modified foods this study examined relevant articles from 13 leading prestigious newspapers from countries of the world. Articles on genetically modified foods containing 250 words or more between the time span of July 1, 2003 to July 31, 2012. The reason for selecting the sample inception period was the United Kingdom's approval of commercial cultivation of genetically modified maize. July 2003 was the first time the British government approved the cultivation of a genetically modified crop. The genetically modified food debate is highly centered in the U.K., and people worldwide look to the U.K. as an opinion leader in this debate. Therefore, public opinion about the issue of genetically modified foods throughout the world likely changed after this date. Because genetically modified foods is an issue that is still frequently debated in newspapers, the sample

ending date was selected to be as close to the time of the study as possible, on the nearest

anniversary of the sample's inception, July, 2003. Because genetically modified foods is an

international issue, newspapers were chosen from several nations throughout the world. The

following papers were selected for this study for data collection: *Sydney Morning Herald,*

Toronto Star, China Daily, Times of India, Japan Times, The Nation, New Straits Times, This

Day, Turkish Daily, New Vision, The London Times, The New York Times and *The Herald.*

Articles from these newspapers were analyzed using both qualitative and quantitative

methods in determining how the topic was covered. Qualitative coding explored the media

frames and themes of the articles, while quantitative coding examined the "prominence" and

"direction" of the articles.

Qualitative Measures

While analyzing each article, two frames were used regarding genetically modified

foods. Every article was examined for the presence of either two of the following frames:

whether genetically modified foods are perceived as favorable or unfavorable in the public eye.

Quantitative Measures

Article Prominence

Each article examined was coded using two scores: prominence and direction. The

prominence score is a numerical rating that ranges from 3-16 points. Four dimensions were

analyzed in order to establish the prominence score. The first is placement, which refers to the

positions of an article in a newspaper (front page of first section, front page of interior section,

inside of first section, or other). Secondly, headline size focuses on the number of words that

comprise the headline of the article. The third dimension is article length, which refers to the

total number of words in the article. The final measurement includes photographs, graphics or

any type of visual aid found in the article (one, two or more). The higher the numerical rating

given an article, the higher the prominence score will be, as illustrated in Table 1:

Table 1: Prominence Score*

(for coding databases)

Dimension	4	3	2	1
Placement	Front page of first section	Front page of inside section	Inside of first section	Other
Headline Size (# of words)	10+	8-9	6-7	5 or fewer
Length of Article (# of words)	900+	650-899	400-649	150-399
Photos/Graphics	2 or more	1		

* Copyright John C. Pollock 1994-2011

Article direction. After receiving a prominence score, the article is scored based on "direction",

a category based on the content of the frames it uses. The directions indicated whether an

articles primary frame is "Favorable", meaning it supports genetically modified food,

"Unfavorable", meaning it does not support genetically modified food, or "Balanced/Neutral".

 The distinction for the directions is based upon the following criteria:

Favorable. Any coverage expressing the benefits or positive aspects of genetically modified

food, presenting it in a positive light, was categorized as "Favorable". For example, an article in

Kenya's *The Nation* stated, "Adoption of biotechnology to create genetically modified crops

could be the ultimate answer to Africa's falling food yields," (Kusimba, 2004). Additionally, an

article in Japan Times stated that "two [genetically modified crop] varieties produced up to 20 percent higher yields than non-modified crops, (Japan Times, 2008). These two articles were coded as favorable because they stressed the benefits of genetically modified foods and downplayed the possible risks.

Unfavorable. Any media coverage that focused on the negative aspects of genetically modified food and portrayed the issue in a negative way was categorized as "unfavorable". For example, and article in *Sydney Morning Herald* stated that, " Pollen from genetically modified plants does not restrict itself to where the plants grow, but blows in the wind and can fertilise neighbouring farmers' crops. Seeds from GM crops can spread inadvertently, contaminating non-GM crops" (Devine, 2004, p.12). Additionally, an article in *China Daily* stated, "There is really no final judge on the genetically modified food safety" (*China Daily,* 2004). These two articles were coded as unfavorable because they stressed the risks of genetically modified foods and downplayed the benefits.

Balanced/neutral. Articles were coded as "Balanced/Neutral" if they demonstrated equal coverage of both sides of the issue of genetically modified food. Articles in this category debated both the advantages and the disadvantages of the issue. An article in *The London Times* stated, "In Europe the contention continues despite the fact that millions of US citizens eat GM soya without any ill-effects. European consumers' opposition to GM foods has had serious repercussions for plant research, for the commercial development of new crops and, most importantly, for developing countries that could benefit most" (Romer, 2005, p.42). Another article in *The Turkish Daily* stated, "Genetic agriculture and transgenic products are rapidly becoming widespread, despite the ongoing debate regarding their impact on public health and biodiversity," (Turkish Daily, 2008). These two articles were coded as balanced/neutral because

they discussed both the benefits and risks of genetically modified foods equally, taking no side

on the issue. At least half the articles were read by two coders, resulting in a Scott Pi coefficient

of inter-coder of reliability of .8270.

Calculating a Media Vector

After analyzing 13 newspapers from nations worldwide, a "media vector" was

calculated using the Janis-Fadner Coefficient of Imbalance. To calculate the media vector,

article "projection" was measured by combining prominence and directional scores. This is

similar to vectors used in physics which combine magnitude and direction to measure impact

(Pollock, 2007). Media Vector Scores range from +1.00 and -1.00. Coverage with a favorable

frame for genetically modified food had a score between 0 and +1.00, and unfavorable frames

had scores between 0 and -1.00. This is depicted in Table 2:

Table 2

Calculating a Media Vector*

f = sum of the prominence scores coded "favorable"

u = sum of the prominence scores coded "unfavorable"

n = sum of the prominence scores coded "balanced/neutral"

r = f + u + n

If f > u (the sum of the favorable prominence scores is greater than the sum of the

unfavorable prominence scores), the following formula is used:

      Favorable Media Vector: (Answer lies between 0 and +1.00)

      FMV = (f2 - fu)

         r2

If i < e (the sum of the unfavorable prominence scores is greater than the sum of the

favorable prominence scores), the following formula is used:

      Unfavorable Media Vector: (Answer lies between 0 and -1.00)

      UMV = (fu - u2)

         r2

* Media Vector copyright John C. Pollock (2000–2011)

Procedures

      Connections between national characteristics and Media Vectors were

investigated via Pearson correlations and regression analysis. Pearson correlations were utilized

to determine which national characteristics were more strongly tied with the Media Vectors. Regression analysis was employed to determine the relative potency and significance of each independent variable. Cross-national demographics and coverage emphasizing favorable or unfavorable public opinion regarding genetically modified foods were found to have strong correlations when analyzed using these two methods.

Results

This study investigated newspaper coverage of genetically modified foods by comparing media vectors from 13 nations from the period of July 1, 2003 to July 31, 2011. Eight of the thirteen media vectors showed favorable coverage of the issue, with scores ranging from .0602 to .2327. The remaining five cities yielding media vectors showing unfavorable coverage of genetically modified food ranged had scores ranging from -.0186 to -.4436. The media vectors had a wide score range of .6763. *Table 3* shows the complete list of all 13 media vectors by nation.

Table 3

Media Vector by Nation

Nation	Newspaper	Media Vector
Uganda	*New Vision*	.2327
United Kingdom	*The London Times*	.2417
Canada	*Toronto Star*	.2114
Nigeria	*This Day*	.1947
Kenya	*The Nation*	.1776
USA	*The New York Times*	.0831
Zimbabwe	*The Herald*	.069
India	*The Times of India*	.0602
Turkey	*Turkish Daily*	-.0186
China	*China Daily*	-.1759
Japan	*Japan Times*	-.3347
Australia	*Sydney Morning Herald*	-.3666
Malaysia	*New Straits Times*	-.4436

Newspaper coverage of genetically modified foods in Europe yielded the most positive media vector score of any region of the world. This was initially surprising, because many of the policies of the European Union prohibit or hinder the production and trade of genetically modified foods. However, after closely examining the specific articles from European nations, it seems that the policies of the European Union do not reflect the interests of the public in this issue.

Another region that yielded a positive media vector score was Africa, with a score of 0.1685. Because many countries in Africa face poverty, hunger and malnutrition, it is reasonable to expect that the public would be in favor of genetically modified foods.

The North American region also yielded another positive media vector, with a score of 0.1473. North America has a vested interest in trading genetically modified food, as the United States in particular has large companies, such as Montsano, who specialize in genetically modified seed production. Furthermore, Americans, who are known to frequent fast food restaurants and eat microwavable food, are likely to see genetically modified foods as a quick fix to the problem of world hunger, without worry for the potential health risks.

The Middle East, with a media vector score of -0.0186, displayed an unfavorable view of genetically modified foods. Turkey, which was the only country from the Middle East sampled, has been making an effort to align with the policies of the European Union. Mentioned earlier, the European Union is largely against the trade and production of genetically modified foods within Europe. Therefore, it is likely that this is the reason for Turkey having an unfavorable view of the issue.

Asia, with a media vector score of -0.2235, also displayed an unfavorable view of genetically modified foods. There are many reasons that the public of Asian countries may not support genetically modified foods. One reason, involves the soybean, which is a staple in the Asian diet and a crop that is frequently genetically modified. As mentioned in many of the articles, which were sampled, companies that produce food using the soybean are skeptical of using genetically modified soybeans. Additionally, many articles from Asian countries alluded to the fact that scientific reports claiming genetically modified foods to be safe may have been altered or skewed. Overall, it seems that Asian countries are very skeptical of the health effects of genetically modified foods.

Finally, Oceania yielded the most negative media vector score of -0.3666. Australia, which was the only country sampled from this region, seems to look to European policies when forming an opinion about this issue. This could be a reason why the media vector score of this region was so negative.

Table 4 shows a complete list of media vector scores by region:

Table 4

Media Vector by Region

Region	Media Vector
Europe	0.2147
Africa	0.1685
North America	0.1473
Middle East	-0.0186
Asia	-0.2235
Oceania	-0.3666

Results from Pearson correlations show the connections between national characteristics and variations in coverage of genetically modified food. The Pearson correlations show the

association between national media vectors and national characteristics. The list of Pearson

correlations is shown in *Table 5*.

Table 5

Pearson Correlations

Characteristic	Pearson Correlation	Significance
Happiness	-0.635	0.01**
GDP added from agriculture	0.519	0.042*
Fertility	0.493	0.043*
Infant mortality	0.485	0.046*
Poverty	0.492	0.052
Hospital beds	-0.465	0.055
Literacy rate	-0.425	0.074
Agricultural land	0.42	0.076
Population <14	0.401	0.087
Newspapers	-0.362	0.124
Rural population	0.346	0.124
Undernourished	0.322	0.142
Physicians per 100,000	-0.299	0.161
Permanent cropland	-0.274	0.183
Oil produced	0.268	0.213
Organic produce	0.227	0.228
Gas produced	0.254	0.239
Food production	-0.213	0.242
Journalists in prison	-0.206	0.25
Mobile phones	-0.2	0.256
Gas consumed	0.208	0.282
Coal consumed	-0.14	0.324
Coal produced	-0.154	0.326
Organic land	0.124	0.344
Electrity consumed	-0.117	0.352
Gini Index Score	0.105	0.367
Electricity produced	-0.104	0.367
Crops produced	-0.085	0.391
GDP per capita	-0.084	0.392
Free press	-0.076	0.403
Industrial growth	-0.075	0.404
GDP	-0.073	0.406
Oil consumed	-0.046	0.44
Road network	-0.031	0.46

** = Significant at .01 level
* = Significant at .05 level

Violated Buffer Hypothesis Supported *Average Happiness Score*

It was hypothesized the higher a country's average happiness score on the World

Database of Happiness, the less favorable media coverage of genetically modified foods. People

with privilege, even more specifically, people who are happy, are likely removed from the issue

of hunger. Because genetically modified foods benefit the poor and undernourished, it is likely

that people with privilege will only see the negative aspects and potential risks of genetically

modified food. Therefore, it is reasonable to expect that these people will have unfavorable

opinions of genetically modified foods, and newspaper coverage will reflect that. Pearson

correlations showed a strong relationship between nations with high average happiness scores (r

$= -0.01$, $p = 0.635$), supporting the violated buffer hypotheses.

Agricultural Contribution to GDP Correlates with Favorable Coverage

It was hypothesized that the greater the value added to a nation's GDP from agriculture,

the more favorable the media coverage of genetically modified foods. Pearson correlations

demonstrated that in nations with a higher agricultural contribution to GDP, favorable coverage

of genetically modified foods was more likely ($r = 0.042$, $p = 0.519$), supporting this hypothesis.

Nations with higher proportions of their GDP coming from agriculture have a major stake in the

issue of genetically modified foods. Crop producers have the potential to make more money

from genetically modified foods, as they produce larger crops with less disease. Therefore, it is

makes sense that in nations that are so dependent on agriculture, newspaper coverage will be

favorable towards this issue.

Vulnerability Hypothesis Supported *Fertility Rate and Infant Mortality*

It was hypothesized that the higher the fertility rate and higher the infant mortality rate in

a nation, the more favorable the newspaper coverage of genetically modified food. Vulnerable

populations are more likely to be in favor of genetically modified food, as it may alleviate issues

of hunger and starvation. More specifically, fertility gives way to a larger population, which puts

a greater strain on the nation's economy and resources. Additionally, nations with higher infant

mortality rates are likely to be poor and undernourished. Therefore, these populations would

likely be in favor of genetically modified food. The Pearson correlation demonstrated a

significant relationship between fertility and infant mortality rates and favorable coverage of

genetically modified foods ($r = .493$, $p = .043$).

Regression Analysis

A regression analysis that linked national characteristics and media vectors determined

percent agricultural land in a nation to be the most significant variable, accounting for 64.1% of

the variance. Another significant variable was Average Happiness Score, which accounted for

23.0% of the variance. Together, these two variables proved to be very significant, counting for

87.1% of the variance. Both of these variables were found to correlate with favorable coverage

of genetically modified foods, supporting their respective hypotheses. The regression analysis is

represented in *Table 6.*

Table 6

Regression Analysis

Model	R (Equation)	R Square (Cumulative)	R Square Change	F Change	Significance of F Change
Agricultural Land	*.801*	*.641*	*.641*	*16.061*	*.003*
Agricultural Land, Happiness	*.933*	*.871*	*.230*	*14.260*	*.005*

Score					

Conclusions and Implications for Further Research

All of the significant findings of this study proved the original hypotheses to be true, further supporting validity the community structure approach. Furthermore, these results respectively supported each of the main umbrella hypotheses – violated buffer, vulnerability and stakeholder. These results further supported and enhanced the findings of Pollock, Maltese-Nehrbass, Corbin and Fascanella's 2010 community structure study on genetically modified foods.

The results of this study are strongly correlated to specific patterns of newspaper coverage of critical issues. These results show a global trend of vulnerable and stakeholder populations supporting genetically modified food and privileged populations opposing the issue. These results are especially powerful, because they reflect newspaper coverage of a critical issue on a cross-national level.

While this study yielded strong results, there were some limitations that could have had an effect on the outcome. First of all, there was a very small sample of newspapers to work with. Many national newspapers simply did not cover the issue of genetically modified foods, and therefore could not be studied. Because of this, only one newspaper in Europe (*The London Times*), one newspaper in Oceania (*Sydney Morning Herald*) and one newspaper in the Middle East (*The Turkish Daily*) were sampled in this study. Additionally, newspapers in South America could not be used because it was difficult to translate the articles into English. It would have been interesting to see the perspective of South American nations on this issue.

It would be interesting to examine specific regions of the world in further detail in regards to this issue. For example, since many African countries struggle with hunger, a study could be conducted on the coverage of this issue in Africa specifically, possibly examining specific countries or more specific periods of time. Additionally, a follow-up study could be conducted, specifically looking at the attitude differences between the European citizens and the policy makers of the European Union, considering the attitude discrepancy that was found in this study.

This analysis of cross-national newspaper coverage of genetically modified foods using the community structure approach showed that there is still a great controversy over this issue with neither side outweighing the other in support. Because this study strengthened previous research on the topic, it is extremely beneficial to the field of communication studies. Yielding many significant findings, this paper reinforced the validity of the community structure approach, and therefore it should be used in further research. The community structure approach is extremely useful and beneficial in explorations of associations between community characteristics and media coverage of notable issues and controversies in today's society.

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