

A recipe for change on both sides of the Atlantic?

A critical analysis of digital media coverage of GM food in the UK & US

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1. Introduction

Genetically modified (GM) foods were introduced to the consumer market in the United States (US) in 1994 and United Kingdom (UK) in 1996. Despite arguments that GM agriculture produces better yields with more efficient techniques and increases food security for a growing population, there has also been much controversy on the issue. Political, economic and ethical concerns exist over unknown health impacts, environmental damage through cross-pollination and loss of bio-diversity, as well as intellectual property and market monopoly. GM food is now widespread in US, with limited regulation or labeling requirements, while in the UK there are bans on locally grown GM produce, meaning the limited available GM food is imported, mainly from the US. The UK has stricter rules about GM food labeling standards, as well as a history of high-level media attention and political debate. Due to the history of higher acceptance level of GM food in the US, and higher opposition in the UK, I have chosen these two countries for a comparative frame analysis of digital media to examine current trends in media coverage of GM food.

A literature review first sheds light on the various influences on GM food communication, as well as the link between media coverage and public acceptance levels in the US and UK. The influence of risk communication is discussed in relation to the mediation of GM food, as well as the varying influences from the science industry and social movements, two often-opposing players in the GM food debate (with science often adopting a pro-GM stance, and social movements an anti-GM position). In the second half of the paper, a frame analysis is used to compare digital media coverage of GM food in the UK and US between Oct 2011 and March 2012, with digital media representing an increasingly important source of news media for a globalised readership. The results are analysed based on Maesele's frames matrix of the GM food debate (2010), and then interpreted in relation to the historical portrayal of GM food in the US and UK and various influences on its media coverage.

The historical higher public acceptance levels of GM food in US compared to UK gave an expectation of anti-GM bias in current UK media, and pro-GM bias in US. However, my frame analysis of current digital media revealed some unexpected trends. UK digital media presented, on average, a more pro-science and anti-environmental bias, while US presented a more balanced coverage, with a higher awareness of risks, and higher level of criticism towards GM food in general. In

hypothesising reasons for these trends, I look to the historical and cultural differences between the two countries, competing voices in the current GM food debate, and their current levels of influence within the media. Finally, I raise issues and concerns, possible influencing factors on the results (such as the nature of digital media), and ideas for further research.

2. Key terms

Genetic technology is the manipulation of an organism's DNA structures through genetic engineering. *GM food* is derived from genetically modified organisms, the most common consumer products being soybean, corn, canola, rice and cottonseed oil (European Parliament and Council of the European Union, 2001).

The *media* refers to media technologies reaching large audiences via mass communication. In this essay I refer to media in relation to news media with its focus on delivering news to the public (Potter, 2008). *Digital media* refers to forms of electronic media with data stored in digital format (Long et al., 2012). For this essay I refer to digital media as online journalism, published and distributed on the Internet through news websites.

Social movements are groups of individuals or organisations focused on specific political or social issues through group action and campaigns. Social movements are vehicles for ordinary people's participation in public politics (Tilly, 2004).

Frame analysis is a multi-disciplinary social science research methodology and theoretical approach, with 'framing' being the process "by which a communication source, such as a news organisation, defines and constructs a political issue or public controversy" (Nelson, Oxley & Clawson 1997:221). A *frame matrix* is a table categorising related frames, used for analysis of the interrelationships of ideas (Armbruster, Anderson & Meyer, 1991).

3. Case study and methodology

My case study is a comparative frame analysis of current digital media articles on GM food from a selection of news websites in UK and US. I have interpreted 'current' as the past six months (Oct 2011 - Mar 2012), choosing to compare the UK and US due to the historically higher public acceptance levels of GM food in the US, and

history of debate and protest against GM food in the UK.

My choice of organisations for the analysis included *The Guardian*, *The Independent* & *BBC* in the UK, and *New York Times*, *Washington Post* and *CNN* in the US. I compared digital media rather than hard-copy news publications due to the fact that digital news has an increasing globalised readership and participatory nature, including citizen-based 'opinion' style journalism, reader forums and interactive polls. My rationale for choice of media organisations was that the so-called 'prestige press' is hugely influential with a 'run-on' effect to other tabloid media. I chose *BBC* and *CNN* specifically for the more mainstream 'television news' focus of their digital coverage.

For interpretation, I used the methodology of frame analysis, specifically Maesele's frame matrix of the GM food debate (2010) to categorise findings. The categorisations of my frame analysis were based on wording, linguistic choices, themes and bias of quotes/speakers. My rationale for this methodology was that framing provides a rich means of investigating the media's reinforcement of dominant ideas and beliefs through specific representations. I found Maesele's frame matrix to be the most thorough and accurate method for framing mediated communications on GM food.

For my analysis, I interpreted and summarised Maesele's 10 frames of GM food media coverage (2010) as follows:

1. Scientific research	Essentially 'pro-GM': encourages development of new technologies through scientific progress, providing better products and 'techno-fix'
2. Economic prospects	Essentially 'pro-GM': GM interpreted as necessary to develop economies and foster economic growth
3. Development	Essentially 'pro-GM': benefits developing countries, 'moral obligation' of developed countries
4. Cost benefit	Essentially 'pro-GM': questions legitimacy of emotional activist campaigns, promotes need to recognise true benefits of GM
5. Scientific uncertainty	Questions our alleged mastery over nature through GM technology

6. Pandora's box	Essentially 'anti-GM': stronger version of #5, GM is an act of irresponsibility, threatening our survival
7. Alternatives	Essentially 'anti-GM': calls for alternatives such as organic agriculture; a different road emphasising where harmony with, rather than mastery over, nature
8. Public accountability	Essentially 'anti-GM': current institutional context is insufficiently accountable for GM commercialisation
9. Corporate control	Essentially 'anti-GM': stronger version of #8, questions economic power relations of GM development
10. Ethics	Essentially 'anti-GM': Questions whether it is ethically acceptable to allow the development of GM, modifying or manipulating 'building blocks of life'

4. Literature review

a. Link between media coverage of GM food and public perception

The media has historically played an intrinsic role in the GM food debate, with coverage evolving over time from science reporting to broader editorial, news, environmental and political journalism (Gaskell & Bauer, 2001). Coverage of GM food issues is often described as subjective and inadequate, arguably due to journalism's limited capacity for long-term views, questionable standards of information gathering, lack of consistent objectivity and tendency for sensationalism (Miller & Riechert, 2000 & Lester 2010). The 'frames' used by the media to represent GM technology are chosen not only to facilitate public understanding, but "to promote and strengthen particular arguments and discourses" (Hansen 2006: 811), and this framing can set an agenda of public concern that is problematic for objective public debate (Marks et al., 2002).

Literature provides evidence that media coverage of GM has raised public awareness and in turn influenced public perceptions, with experiments showing that sentiments towards GM foods become more negative in times of intense media debate (Kalaitzandonakes 2004; Durant, Bauer & Gaskell, 2002). By 1999, with much negative UK press surrounding GM food, British public following news media were more likely to think of GM food technology as "less useful, more risky, and morally troubling" (Kalaitzandonakes 2004). Media influence on public opinion of GM

foods is cumulative, with media reports conferring legitimacy to or discrediting particular groups, and thus “indirectly affect(ing) which perspectives do or do not ultimately come to dominate collective discourse and decision-making” (Priest, 2006 in Augustinos, Crabb & Shepherd 2009:99).

GM food has become a widespread controversial issue in scientific, political and social spheres, and while still debatable how successful the media are in telling people *what* to think, “it stunningly successful in telling people what to think *about*” (Cohen, 1963:13). Public support is crucial in enabling governments and GM industries to exploit new technologies, so it is therefore important we are aware of how media representations are “arrived at, contested, defended, or set aside” (Jasanoff 2004:1; Bauer 2002) in order to understand who is influencing our awareness and perception of GM food, and what their vested interests may be. This established link between media coverage and public opinion lays the theoretical foundation for the interpretation of my frame analysis.

b. Risk communication in relation to GM food

Risk communication is a significant influencing factor on media coverage of GM food. Technological advancement in areas such as genetic modification has created high-consequence modernisation risks that have arguably led to a ‘risk society’, where we do not take personal responsibility for our lifestyles, or the long-term and detrimental environmental effects they cause (Beck, 1992: 29). Those identifying risks are labeled alarmists, while others profit through risks, such as biotechnology companies selling GM food as the ‘natural solution’ to climate change. Social conflicts, such as GM technology, are based on competing rationality claims and interests – also referred to as risk conflicts (Maesele, 2009b). The media have difficulty reporting such conflicts due to their ethical nature, often ignoring some associated risks and exaggerating others. This creates journalistic ambiguity that, since individuals are ‘ambiguity adverse’, leads to a dangerous ‘risk amplification’ in public opinion (Vilella-Vila & Costa-Font, 2008 & Kasperson et al., in Kalaitzandonakes, 2004). Risk communication therefore has a distinct influence on the media’s coverage and portrayal of GM food.

Another important theme in risk perception research is trust. Surveys in both the US and UK reveal that perceptions of trust in government GM regulations are strong

predictors of consumer support (Dittus and Hillers, 1993, in Kamaldeen 2000). Trust in regulatory authorities is traditionally higher in US than UK, with US public acceptance of GM increasing significantly when regulators such as the Food and Drug Administration (FDA) give safety approvals (Hoban, 1998, in Kamaldeen 2000). Trust in government and industry is therefore seen as an important influence on risk perception, as reflected by higher levels of GM acceptance to date in the US.

c. Science communication in the media

Two influential, yet often competing voices in the GM food debate are the science industry and social movements. The science industry often takes a 'pro' stance on the issue with arguments that GM agriculture produces better yields with more efficient techniques, improves resistance to disease and increases food security for a growing population. Social movements are more likely to take an anti-GM stance due to arguments surrounding unknown health impacts to humans and other organisms, environmental damage through unintended cross-pollination of GM genes and loss of bio-diversity, and market monopoly and intellectual property owned by GM technology corporations.

The publishing pattern of scientific communication on GM foods differs to that of mainstream media, with scholarly scientific publications tending to be objective and reportorial, while the press is more interpretive and subjective, especially in digital media forums and opinion pieces (Marks & Kalaitzandonakes, 2003). A stereotypical image exists of science presenting a pro-GM viewpoint, and the media taking an anti-GM bias. McInerney, Bird & Nucci argue that this is a problematic stereotype as when scientific communication is oversimplified it can put "into motion possible ripple effects of public concern" (2004:69). Widespread public resistance to GM food in UK has created significant dilemmas for the relationship between science and society, largely contesting the idea of science providing objective foundations for public policy (Augoustinos, Crabb & Shepherd, 2009). Scientists claim such attacks are unwarranted, blaming the media's exaggerated portrayal of the 'love affair' between techno-science and profit-driven corporations (Plumwood, 2002). US public attitudes to the science industry on the other hand remain generally more positive than UK, due in part to higher levels of government trust and limited public debate on the GM issue (Kamaldeen, 2000).

d. Influence of social movements on the media

Social movement communications are also highly mediated across news channels, with Castells describing the relationship between the media and environmentalists as "tap-dancing ... an ongoing dance that changes tempo quickly and involves improvisation from both partners" (2004: 186, in Hutchins & Lester 2009). Social movements play an important role in shaping ideas that raise public awareness of environmental issues, yet Leahy (1980) claims that their influence on the media and public opinion is only substantial during periods of great national concern, due to the high level of media attention allowing their communications to infiltrate mass media. In periods of low national concern however, their influence is minimised.

While it can be argued that social movements have infiltrated the media enough to influence the low levels of GM food support in UK (Kamaldeen 2000), their views are still largely under-represented in mainstream media, one reason being the highly selective and competitive nature of media inclusion. "News about the environment does not happen by itself" (Hansen, 2010: 72), and social organisations must 'design' and 'frame' visually appealing news stories with digestible commentaries on complex political issues (Eyerman and Jamison, 1989) in order to be picked up by target publications. The internet and digital media offer new opportunities for activists to communicate however, giving them the tools for a more sustainable representation of their brand and campaigns, as well as open, creative and participatory exchanges with the public (Lester & Hutchins 2009, Bennett, 2003; Dahlberg and Siapera, 2007; Donk et al., 2004, in Cottle 2008). My frame analysis of digital media will shed light on whether these new digital communications tools are allowing social movements to better push their messages through to the public.

e. Previous studies on public opinion of GM food in the US and UK

Research shows that major influences on acceptance levels of GM foods in the US and UK are linked to the amount and bias of media coverage, knowledge and understanding level of GM technology, confidence and trust in authorities and other political events of the time (Gaskell, Durant & Allum, 1999, Cook, Robbins & Pieri 2006 & Hoban, 1996, in Kamaldeen, 2000). Pre 1996, GM technology enjoyed fairly positive media coverage in the UK, with corresponding relatively high levels of public support. By early 1999 however, GM created a 'media storm' later called "The Great

GM Food Debate”, which focused on food applications rather than less controversial medical innovations (Eyck 2003). This debate caused public opinion on GM food in the UK to shift from general acceptance in 1996 to widespread disapproval by late 1999 (Durant & Lindsay 1999).

In the US, GM food entered the food system with minimal public concern due largely to non-restrictive regulations. This caused limited public debate and resulted in relatively low public concern. 50% of US's soy crop is now GM and thousands of GM food products are available in US supermarkets. Despite widespread public acceptance, the US public shows poor understanding of GM technology, scoring an average of 2.43 compared to the European (including British) score of 2.76 in knowledge and basic understanding levels about GM (The Economist/Angus Reid Poll, in Kamaldeen, 2000). Another study shows 58% of respondents in UK viewed trends towards GM foods negatively as opposed to 51% in US (Angus Reid, 2000, in Kamaldeen, 2000), leading to the inference that higher awareness and understanding of GM foods leads to higher levels of opposition.

GM awareness in UK is also attributed to sustained high levels of media attention. Durant & Allum's 1999 study concluded that negative public perceptions of GM food in UK not only reflected the bias of press coverage, but were also influenced by levels of press coverage, with higher amounts of press coverage signaling lower acceptance levels. Furthermore, Marks, Kalaitzandonakes, Allison & Zakharova's (2003) found UK press to be more negative than US in coverage of GM crops. Greater negative public opinion and lower acceptance level of GM food in UK can therefore be linked to the compound effects of greater media coverage, greater *negative* media coverage and higher levels of awareness and understanding of GM foods.

Marks & Kalaitzandonakes (2003) offer further hypotheses for the comparatively negative reception of GM foods in UK including refusal by British consumers to accept risk in the face of little perceived benefit; lack of trust in UK food regulatory agencies; perception that scientists unreliably manage consequences of new technologies; higher UK food labeling regulation; anti-American sentiment, and UK media sensationalism. Whilst some of these hypotheses are generalisations, they do point out that cultural difference and other complex, deep-rooted social and political motivations influence the differing acceptance levels of GM foods in the US and UK.

5. Frame analysis of digital media coverage of GM food in the UK and US

a. Research findings

In my research I found a total of 52 articles relating to GM food dated between October 2011 – April 2012 from the chosen media organisations; 30 articles from UK press, and 22 articles from US press. The breakdown of articles found was *The Guardian* (20), *New York Times* (10), *Washington Post* (8), *BBC* (6), *The Independent* (4) and *CNN* (4). Through the analysis of wording, themes, content, linguistic choices, article structure, speakers quoted and bias in reporting, I categorised each article based on Maesele's frame matrix of the GM food debate (2010), the 10 frames being: Scientific research, Economic prospects, Development, Cost benefit, Scientific uncertainty, Pandora's box, Alternatives, Public accountability, Corporate control and Ethics. Many of the articles presented more than one frame and I located 109 frames in total in the 52 articles studied.

i. Findings from UK study

Most featured frames in my analysis of UK digital media were Development (19 feature, 28.4%), Scientific Research (13 features, 19.4%) and Cost Benefit (10 features, 14.9%). Least featured frames were Alternatives and Ethics with just one feature each (1.5%) (*Figure i*).

In *The Guardian*, most featured frames on GM food were Development (14 features, 30.4%) then Scientific Research and Cost Benefit (8 features, 17.4% each), and least featured frames were Alternatives, Scientific Uncertainty and Ethics (1 feature, 2.2% each). In *The Independent*, most featured frames were Development, Scientific Research and Corporate Control (2 features, 22.2% each), and least featured frames were Economic Prospects, Pandora's Box, Alternatives and Ethics (no features). In *BBC*, most featured frames were Development, Scientific Research and Economic Prospects (3 feature, 25.0% each), and least featured frames were Alternatives, Public Accountability, Corporate Control and Ethics (no features).

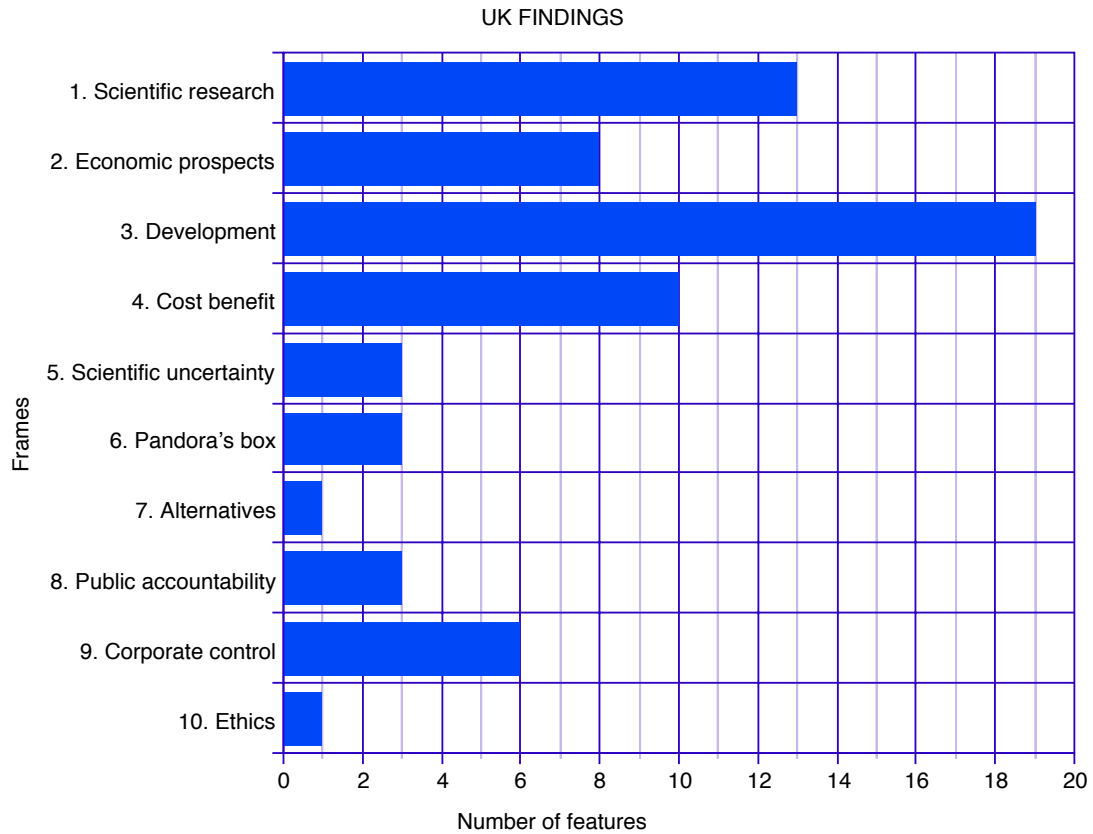


Figure i: Frames featured in UK digital media analysis

ii. Findings from US study

Most featured frames in my analysis of US digital media on GM food were Public Accountability and Scientific Research (7 features, 16.7% each), then Alternatives and Corporate Control (6 features, 14.3% each). Least featured frame were Cost Benefit (no features) and Economic Prospects (2 features, 4.8%) (*Figure ii*).

In *New York Times*, most featured frames on GM food were Scientific Research, Alternatives, Public Accountability and Ethics (each with 3 features, 15.8%), and least featured frames were Development and Cost Benefit (no features). In *Washington Post*, most featured frames were Public Accountability (4 features, 26.7%), Corporate Control (3 features, 20.0%) and Alternatives (2 features, 13.3%), and least featured frame was Cost Benefit (no features). In *CNN*, most featured frames were Scientific Research and Development (3 features, 37.5% each), and least featured frames were Cost Benefit, Scientific Uncertainty, Pandora's Box, Public Accountability, Economic Prospects and Ethics (no features).

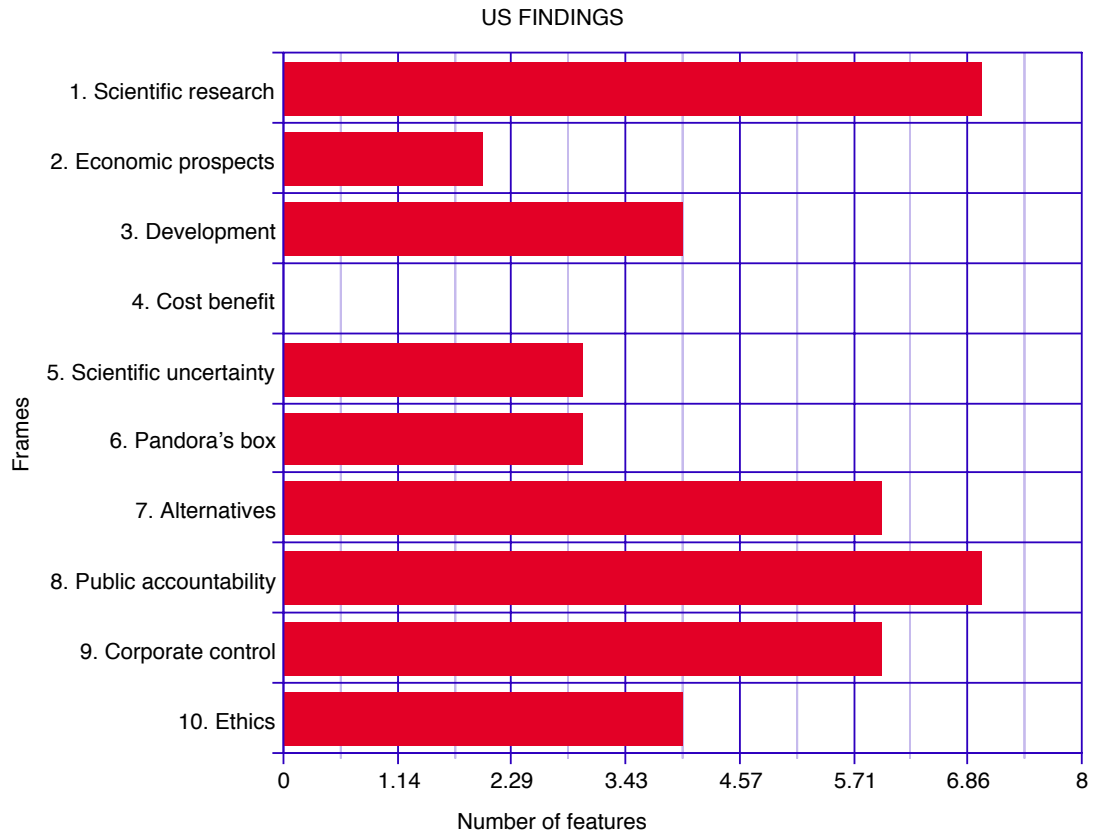


Figure ii: Frames featured in US digital media analysis

b. Analysis of findings

According to Maesele's frame matrix (2010), the most featured frames in UK digital media (Development, Scientific Research and Cost Benefit) can be classified as pro-GM frames. The least featured frames in UK digital media (Alternatives and Ethics) can be classified anti-GM frames. Much GM food coverage from UK focused on themes such as the opportunity for development of new GM technologies through scientific progress to provide better, more efficient products. Phrases such as 'needing to understand true benefits of GM' were reiterated, with a bias towards quotes from pro-GM speakers. Many articles presented GM as a necessity for the development of the British economy and industry, to most effectively aid developing countries and help solve the global food crisis in the threat of climate change. The majority of UK articles on GM food had pro-science and anti-environmental bias, with many neglecting to present alternatives to, or adequately represent the risks involved, with GM technology. This fits with Kalaitzandonakes' theory that the media

often have difficulty reporting on 'ethical' risks, leading to ambiguity and 'risk amplification' in public opinion (2004).

Of the most featured frames in US digital media, three can be classified as ant-GM (Public Accountability, Corporate Control and Alternatives) and one as pro-GM (Scientific Research). The least featured frames in US digital media (Cost Benefit and Economic Prospects) can both be classified pro-GM frames. The frames found from US were more varied than from UK, with more articles offering a balanced debate on GM food, often quoting both pro- and anti-GM speakers within the same article. Many US articles explored themes such as continued scientific advancements and development of new GM technologies, but on an equal level (and often in the same articles) featured discussions of public accountability, especially on the issue of food labeling. There was significant reporting on the issue of corporate control (or market monopoly) of GM technology, with references to controversies surrounding the corporation Monsanto, plus a number of reports promoting the rise of GM alternatives such as organic and homegrown food. Cost benefits and economic prospects hardly featured in the US articles, perhaps because GM food is already so widely integrated into US systems that debates on the economic benefits are no longer press-worthy. The ethics of GM food had a higher prominence in US digital media than in UK.

Since the literature revealed a history of anti-GM media coverage in UK and lower acceptance levels of GM technology, I was surprised at the number of pro-GM articles in the UK media compared to the more varied reporting by US media. Many UK articles spoke of public acceptance for GM foods increasing, showing bias towards pro-GM speakers and describing the public as having a 'change of heart' on their traditional anti-GM stance. The *BBC* article 'Calls for a mood change on GM foods', reported: "[t]he public mood is changing ... we need a grown-up debate about GM - we need to look at how we can unlock the power of that science to help the rest of the world" (McGurran, 2012), and *The Guardian's* 'Should the UK now embrace GM food?' reported: "There is less hostility now towards the technology, coupled with signs of positive support from some politicians within government ... I think it is a moral imperative to keep actively researching these technologies" (Hickman, 2012). In UK coverage, GM food was often referred to as 'natural' and the 'environmentally friendly solution' to climate change e.g. "The genetic modification harnesses one of the plant world's own defense mechanisms" in 'GM wheat that wards off aphids trialed in UK' (*The Guardian*, 2012), and "It's a very clever combination of

biotechnology, chemistry and natural ecology... using GM as a tool to enhance natural defense mechanisms is a big step forward for crop protection that also benefits the environment” in *BBC's 'Exploiting the smell of genetically modified fear'* (Feilden, 2012).

In the study of US digital media I expected to find more pro-GM stories due to higher acceptance of GM foods in US. While I found fewer articles on GM food in general (22, as opposed to 30 from UK) - endorsing the theory that there is generally less US public debate on the issue (Kamaldeen, 2000) - the articles I did locate were more balanced, featuring a broader social and political context with debate about public accountability and corporate responsibility. There was however also a bias toward development and scientific advancement frames, supporting the theory that US public generally has a positive attitude towards the science industry (Kamaldeen, 2000). The issue of GM food labelling featured substantially in the US press, for example: “No known health risks are associated with eating transgenic foods (though many scientists say it is too soon to assess the effects) ... F.D.A. guidelines say that food that contains genetically modified organisms don't have to say so and can still be labeled “all natural” in *New York Times' 'A Suit Airs Debate on Organic vs. Modified Crops'* (Moskin, 2012). There were also multiple reports of controversies surrounding GM corporations, e.g.: “Monsanto has been at the center of dozens of protests over the years, most often over health problems possibly associated with genetically modified foods it has produced... Last month, a two-year-old appointment of a former Monsanto vice president to the Food and Drug Administration sparked an online petition for his removal” in *Washington Post's 'Monsanto found liable for chemical poisoning in France'* (Flock, 2012).

Overall, US media featured higher levels of anxiety and concern, and raised more ethical questions in their reporting of GM food. For example, in the *Washington Post* article '*Coalition urges tighter controls on 'extreme genetic engineering'*', the environmental organisation *Friends of the Earth* was quoted as leading the call for “stronger government regulations over ‘extreme genetic engineering’ and a moratorium on the commercial use and release of lab-created organisms” due to the fact “the technology is outpacing the research needed to understand environmental risks” (Vastag, 2012), an example of communications from social movements successfully infiltrating US mainstream media.

Examples were found of UK press patronising anti-GM protestors, labeling public resistance to GM as irrational and emotional, and lacking scientific knowledge or understanding. Opponents to GM food were categorised as ‘anti science’ and ‘anti progress’, with reference to the need to conduct important GM trials behind security fencing to keep out “animals and environmental protestors” in *BBC*’s ‘Anti-insect wheat trials launched’ (Shukman, 2012). Many articles promoted the idea that it’s ‘only a matter of time’ before the GM food industry expands in UK, with examples such as, “The green movement jumped on GM as anti-environment, while anti-capitalists claimed it was designed to maximise profits at the expense of the people ... But now scientists believe the time has come to fight back” (from *The Independent*’s ‘GM 2.0: A new kind of wheat’, Conner, 2012), and “GM got off to a bad start ...It can only be hoped that the Rothamsted wheat crop – with its highly targeted, non-lethal promise of natural deterrence – can help tilt the balance back in favour of progress” (from *The Independent*’s ‘A genetically modified renaissance’, 2012).

A concerning trend identified in UK press was the implication that anti-GM campaigners were delaying or obstructing the implementation of the ‘natural solution’ to increasing global food shortages. The fact that risks or alternatives to GM were rarely discussed in this context was disconcerting, possibly based on the amount of pressure on the media by government and corporate powers with a pro-GM agenda. Also noted was the lack of a clear ‘voice’ from social movements in UK press, as if they had been drowned out by more powerful and influential players such as pro-GM lobbyists from the science industry and GM technology corporations. In relation to Leahy’s theory of environmental groups having greater influence on the media in times of high national concern (2008), it could be claimed that UK is in a period of low national concern regarding GM food, thereby allowing pro-GM voices to rise and gain substantial strength and influence within the media sphere. On the other hand, with the US press taking a more objective stance and rational debate on the issue, it could be inferred that US national concern surrounding GM food may actually be growing.

6. Conclusion

After examining the various players that influence media coverage and portrayal of GM food through frame analysis of current digital media coverage in the US and UK, contrasting shifts can be seen in the media’s current portrayal of GM foods on both

sides of the Atlantic. UK media shows bias towards higher public acceptance levels towards GM foods by downplaying risk communication, reiterating economic and 'progress' benefits, and amplifying communications from the science industry over social movements. In US media by contrast, a more balanced debate is presented, with a shift towards increased public skepticism of GM food with concerns such as ethics and inadequate regulation, and promotion of GM alternatives.

Possible reasons for these shifts include: a) the already widespread distribution of GM food in the US causing less political and economic pressure on the media to promote certain pro-GM frames, thereby giving space for a more balanced debate and increased risk communication, with the opposite phenomenon happening in the UK, and b) social movements being able to more effectively infiltrate the media and get their anti-GM messages through in this 'low-pressure' GM food debate currently taking happening the US, as opposed to the more 'high-pressure' GM food debate in the UK. It can be inferred that the time period of the study has coincided with a time of transition with both US and UK, with US moving from a position of high GM usage and public acceptance, to one of increased risk awareness and questioning of GM technology; and UK, in a position of low usage, currently experiencing a high level of pressure to increase its acceptance of GM for reasons such as political tension, financial motives such as economic recession, or public pressure for a solution to environmental issues such as climate change and global food shortage.

Given the established role of the media in linking awareness, understanding and acceptance of GM foods, these trends could lead to higher levels of public acceptance levels towards GM food in the UK, and jeopardise current widespread public acceptance of GM food in the US. For anti-GM advocates in the UK, this is a worrying trend. Despite the benefits of new independent forms of digital media as tools for these social movements, their messages do not seem to be infiltrating still-powerful mainstream media channels, this 'lack of voice' possibly leading to decreasing influence on media debates and widespread public opinion on GM food. For anti-GM advocates in the US however, these trends can be described as more positive to their plight, with a higher amount of social movement communications infiltrating the media and a generally more balanced reporting trend on GM food.

These research findings raise many questions, such as whether these trends are ongoing and increasing, whether the findings have been skewed by other factors such as current political environments or short-term media infiltration from certain

pressure groups, and how much impact and influence these shifts in media focus will have on future public acceptance levels of GM food. Further research is therefore needed on current media trends of GM food coverage in the US and UK. I would recommend a critical analysis of a wider selection of news websites, as well as location-based print media from the same time period, due to the possibility of research data being skewed by the specific digital media news publications chosen, and/or the questionably more subjective and globalised nature of digital media. Regardless, these findings are an eye-opener to the constantly shifting nature of the players influencing media coverage and portrayal of GM food, and the fact that pressure groups at both ends of the spectrum in the GM food debate cannot afford to rest on their laurels in terms of the influence they have on the media or public acceptance levels at large.

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8. Appendix

a. Case study articles

i. Articles from UK digital media

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b. Research data

i. Data from UK digital media

The Guardian

1. Scientific research = 8/46 (17.4%)
2. Economic prospects = 5/46 (10.9%)
3. Development = 14/46 (30.4%)
4. Cost benefit = 8/46 (17.4%)
5. Scientific uncertainty = 1/46 (2.2%)
6. Pandora's box = 2/46 (4.4%)
7. Alternatives = 1/46 (2.2%)
8. Public accountability = 2/46 (4.4%)
9. Corporate control = 4/46 (8.8%)
10. Ethics = 1/46 (2.2%)

The Independent

1. Scientific research = 2/9 (22.2%)
2. Economic prospects = 0/9 (0.0%)
3. Development = 2/9 (22.2%)
4. Cost benefit = 1/9 (11.0%)
5. Scientific uncertainty = 1/9 (11.0%)
6. Pandora's box = 0/9 (0.0%)
7. Alternatives = 0/9 (0.0%)
8. Public accountability = 1/9 (11.0%)
9. Corporate control = 2/9 (22.2%)
10. Ethics = 0/9 (0.0%)

BBC

1. Scientific research = 3/12 (25.0%)
2. Economic prospects = 3/12 (25.0%)
3. Development = 3/12 (25.0%)
4. Cost benefit = 1/12 (8.3%)
5. Scientific uncertainty = 1/12 (8.3%)
6. Pandora's box = 1/12 (8.3%)
7. Alternatives x 0/12 (0.0%)
8. Public accountability x 0/12 (0.0%)
9. Corporate control x 0/12 (0.0%)
10. Ethics x 0/12 (0.0%)

Total UK

1. Scientific research = 13/67 (19.4%)
2. Economic prospects = 8/67 (11.9%)
3. Development = 19/67 (28.4%)
4. Cost benefit = 10/67 (14.9%)
5. Scientific uncertainty = 3/67 (4.5%)
6. Pandora's box = 3/67 (4.5%)
7. Alternatives = 1/67 (1.5%)
8. Public accountability = 3/67 (4.5%)
9. Corporate control = 6/67 (9.0%)
10. Ethics = 1/67 (1.5%)

ii. Data from US digital media

Washington Post

1. Scientific research = 1/15 (6.7%)
2. Economic prospects = 1/15 (6.7%)
3. Development = 1/15 (6.7%)
4. Cost benefit = 0/15 (0.0%)
5. Scientific uncertainty = 1/15 (6.7%)
6. Pandora's box = 1/15 (6.7%)
7. Alternatives = 2/15 (13.3%)
8. Public accountability = 4/15 (26.7%)
9. Corporate control = 3/15 (20.0%)
10. Ethical = 1/15 (6.7%)

CNN

1. Scientific research = 3/8 (37.5%)
2. Economic prospects = 0/8 (0.0%)
3. Development = 3/8 (37.5%)
4. Cost benefit = 0/8 (0.0%)
5. Scientific uncertainty = 0/8 (0.0%)
6. Pandora's box = 0/8 (0.0%)
7. Alternatives = 1/8 (12.5%)
8. Public accountability = 0/8 (0.0%)
9. Corporate control = 1/8 (12.5%)
10. Ethical = 0/8 (0.0%)

New York Times

1. Scientific research = 3/19 (15.8%)
2. Economic prospects = 1/19 (5.3%)
3. Development = 0/19 (0.0%)
4. Cost benefit = 0/19 (0.0%)
5. Scientific uncertainty = 2/19 (10.5%)
6. Pandora's box = 2/19 (10.5%)
7. Alternatives = 3/19 (15.8%)
8. Public accountability = 3/19 (15.8%)
9. Corporate control = 2/19 (10.5%)
10. Ethical = 3/19 (15.8%)

TOTAL US

1. Scientific research = 7/42 (16.7%)
2. Economic prospects = 2/42 (4.8%)
3. Development = 4/42 (9.5%)
4. Cost benefit = 0/42 (0.0%)
5. Scientific uncertainty = 3/42 (7.1%)
6. Pandora's box = 3/42 (7.1%)
7. Alternatives = 6/42 (14.3%)
8. Public accountability = 7/42 (16.7%)
9. Corporate control = 6/42 (14.3%)
10. Ethical = 4/42 (9.5%)