Framing Analysis as a Tool for Science Press Officers: The Biofuel Debate Case in the Argentinean and British Press

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Preface

During 2012 I worked at the Corporate Communications team of the scientific publishing company Elsevier. Part of my duties included collaborating in the press office with the monthly editorial meetings of the Elsevier Research Selection for journalists. My task was looking for research stories with potential interest for the press. During the meetings it was always a challenge to pick stories and decide the specific selection for journalists. I always enjoyed digging for information and prepare my selection. However, knowing what journalists want, what is newsworthy and why some science topics receive more attention than others grabbed my especial attention and became the topic of the following research report.

For the experience and the opportunity to work day by day on a press office I would like to express my gratitude to the Corporate Communications team of Elsevier, especially Harald Boersma, Ylann Schemm and Sacha boucherie. I had a great time working with them.

This thesis wouldn't be possible without the invaluable support of my amazing supervisor Maarten van der Sanden, my deepest appreciation goes to him for his guidance, patience and encouragement. I enjoyed a lot the discussion times with him and his opinions and ideas were always insightful, inspirational and I ended up with millions of ideas.

I also received generous support form Sebastian Olenyi, the specific biofuel case topic came from his suggestions and discussions with him, his feedback became crucial to the development of this research so I would like to express my gratitude to him for his advices and the time he spent helping me in this project.

Special thanks as well to Caroline Whermann and the Science Communication Department of Delft University of Technology for their support on completing this Master.

Finally I would like to express my deepest gratitude to my family that regardless the distance was always giving me support, to Vincent for staying up many nights working with me on the report and to my friends at the TUDelft, especially Dani for making my time in Holland unforgettable.

Enjoy the reading.

Abstract

The study was carried out through the use of a framing analysis of articles published in four newspapers in Argentina and the United Kingdom between January 2011 and January 2013. The study sample of 125 news articles was collected through the electronic news database LexisNexis using the search terms "Biofuels" OR "Biodiesel". Frames were analyzed according to an experimental frame typology, and coding was carried out by the author. Using a coding scheme developed by Valkenburg (1999) frames were coded as either "absent", "dominant", or "present". Additionally a set of topics related to biofuels was also identified. Results found that the generic consequence frame was dominant on the majority of the articles in both countries. However differences were found between the countries on specific frames such as "environmental" and "economic". Analysis on the topics showed that GHG emissions and food security were the most discussed topics on the biofuel debate in the articles coded. The outcome of the research reflects the potential use and applicability of framing analysis in the public relations field especially for press officers.

Summary

Research has found that public relations practitioners specially press officers, need to find new ways to both track the media coverage and improve their understanding of the news in order to improve the communication between practitioner and journalists (Sallot & Johnson, 2006). One of the methods that offer potential solutions to the mentioned problems is framing analysis (Knight, 1999). Widely used in communication studies to analyse social and political news, framing analysis is a new approach to understand the coverage of scientific news and little research has been carried out in this topic.

Framing analysis as stated by Entman in 1993 is "to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described".

By evaluating the coverage of the Biofuel debate in 4 newspapers in two countries (Argentina and the United Kingdom) over two years, the following research aimed to propose a framing analisys model that can be used by science press officers in the biofuel industry.

Two sets of frames and a set of topics were identified: a set of generic frames (Valkenburg, 2000), a set of specific frames (Delshad and Raymond, 2013; Anderson, Allan, Petersen, & Wilkinson, 2005; Nisbet & Huge, 2006 and Boykoff and Boykoff, 2007) and a set of topics (Ismaeli, et al., 2011) in relation to the sustainability issue. After analysing the results the "consequence" was found to be dominant in the news speciffically the "economic"consequence one. In terms of topics the food security topic and the GHG emissions topics appeared to be the most frequent but in los numbers.

Framing analysis as a tool gave insightful clues on how the biofuel debate is covered and portrayed. However the model has some disadvantages and should be implemented carefully. Further research is needed on how framing analysis should be used for science news especially in relation to the ways that the analysis can be applied for the public relation field and the understanding of the dynamics of the media and its implications for public perception.

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List of Abbreviations

CSBP   Council on Sustainable Biomass Production

FAO   United Nations Food and Agriculture Organisation

GHG   Greenhouse Gas

NGO   Non-Governmental Organisation

R&D   Research and Development

SPO   Science Press Officers

UN   United Nations

U.K   United Kingdom

Glossary

Agenda Setting Agenda-setting is the creation of public awareness and concern of salient issues by the news media (McQuail & Windahl, 1993)

Framing To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described (Entman, 1993)

Gatekeeper The gatekeeper decides which information will go forward, and which will not. In other words a gatekeeper in a social system decides which of a certain commodity – materials, goods, and information – may enter the system (Gupta, 2006)

Science Press Officer The primary role of a Science Press Officer (also called information officer or public information officer) is to facilitate interactions between researchers and journalists. Press Officers can help to arrange interviews, write and distribute press releases, and organize and host press conferences to share newsworthy research with the public (Funsten, 2004).

Salience The word salience means making a piece of information more noticeable, meaningful, or memorable to audiences (Entman, 1993).

1 Introduction

1.1 Project context

Nowadays, it is well known that the vast majority of people obtain much of their information about science from mass media. Some of the most important science debates of our times have been conducted on the front pages and in the headlines of the mainstream news. No-one could surely argue that the decisions we have made as individuals and as a society on issues like genetic modified crops, human-animal hybrid embryos and climate change have not been hugely influenced by mass media. (SMEG, 2010)

Several studies have documented this issue by studying the relation between scientific information presented in mass media and the lay public. In 1997 Shanahan et. al. postulated that a significant amount of the public's knowledge of science issues, specifically environmental information is likely to come from the media.

"Certainly much of what most people hear about such issues as the greenhouse effect, global climate change, ozone depletion, water and air pollution, and other environmental threats is likely to come from the media (or from others who have heard it from the media)" (Shanahan, et. al. 1997)

The reason for this phenomenon is that much of the information that people seek including science related information exists outside of their own experiences, and the media is the main source of information (Gamson & Modigliani, 1989).

The American sociologist of science Dorothy Nelkin stated that the media are seen as "*Brokers between science and the public, framing social reality for their readers and shaping the public consciousness about science-related events*". Through her work on researching and chronicling the relationship between science and society, she also described that "*journalists are the ones who help to set the agenda for science public policy. Through the information they convey about risks, they may affect stock market prices and influence product sales. And through the presentation of science news, the media influence public attitudes towards science*" (Nelkin, 2001). This means that not only people's knowledge of science related information can be influenced by the messages sent by the media, but also the perception and attitudes towards scientific issues.

There are other sources of scientific information for the general public including friends, letters, books, films and tapes; however, it is the mass media the primary way that people use to obtain information about science related topics. In other words, the way people understand science and technology is

influenced to a significant degree by how the media covers, interprets and presents science information.

One influential way that the media may shape public opinion is by framing events and issues in particular ways (de Vreese, 2005). Other ways of influencing public opinion include agenda-setting and priming, closely related concepts to framing that will be explained further in this research.

In general terms, **framing involves a communication source presenting and defining an issue.** Despite the varied and sometimes inconsistent meanings of the term in the literature, the notion of framing has gained momentum in the communication disciplines as a tool to analyze media content. It can give guidance to both investigations of media content and to studies of the relationship between media effects in public opinion. (de Vreese, 2005).

Understanding and applying framing research is of particular interest of public relations practitioners, especially press officers. Acting as a link between an organization and the media, press officers have to understand how and when a journalist works (Sallot & Johnson, 2006). By adopting a journalist's orientation, including how they write, what interests them, and what they cover, public relations practitioners are more likely to be successful with their media relations efforts (Pang, 2010). Framing analysis offers a potential way to evaluate, monitor and comprehend the journalistic work.

1.2   The science press officers

Scientists and journalists live in very different worlds. Journalists sometimes accuse scientists of speaking in jargon, and being inaccessible. Scientists on the other side feel that the media either misunderstands or deliberately misrepresents them and their science (Jouber and Bartlet, 2011). The science press officer is the public relations professional that works as a link between scientists and journalists in any organization that produces scientific knowledge. Research institutions, science based companies, universities and NGO's are some of the places where science press officers are present. They understand how both science and the media work. Science press officers play an important and significant role in the scientific information dissemination process by acting as intermediaries between the organization, where some of the novel research is produced, and the media where news stories are written and broadcasted by journalists (**Figure 1**).

Scientists are often unaware of the news value of their research. A goal of the science press officers is to know their research and spot newsworthy stories from reports, papers and meetings or from talking directly to them. Science press officers package and frame science stories for maximum media appeal, without compromising accuracy and avoiding hype (Jouber and Bartlet, 2011).

Tracking the print and broadcast media becomes a key part of a science press officer job. It is only through daily monitoring of newspapers, radio, and TV that the science press officers learn what topics the media is interested in, the political slant and bias in reporting, and the particular journalists

and editors involved. Knowing the nuances of newspaper coverage is essential to be able to target journalists that may be interested in a planned activity from the organization, and to frame issues in a way that will make them as attractive as possible to the media (Édes, 2000).
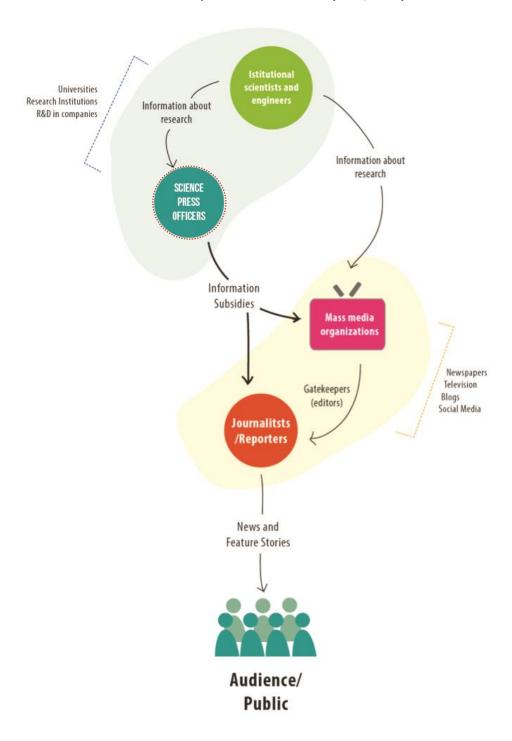
Figure 1. Conceptual model of knowledge transfer from institutional researchers to the public through press officers and mass media journalists. (Adapted from White, 2012)

1.3   Problem definition

Finding ways to know what journalists want and how they work has been documented in the literature as a strategic objective for public relations professionals. It has been stated that practitioners have difficulties understanding what journalists are writing about and how they present and frame the topics they cover (Pang, 2010). A large body of research about the professional relationships, stigmas, and stereotypes between journalists and public relations professionals exists (Waters, et.al., 2010) and much of these source–reporter literature portrays the journalist–practitioner relation as adversarial (Sallot and Johnson 2006).

Framing analysis offers a potential way for science press officers to both track specific media content and consequently improve their opportunities for media catching but also to understand the journalistic work and improve the journalist-practitioner relationship. The following research attends to describe a framing analysis model for scientific news that can be used as a tool by science press officers.

In order to construct and test the framing analysis model presented in this research, a specific science related issue in the news was evaluated as a case study. News articles published in the last two years about the biofuel debate in the Argentinean and British press were analyzed. Both Argentina and the U.K are currently amongst the major biofuel production countries guaranteeing relevant news coverage. Moreover, the selection offers the opportunity to compare two contrasting (geographically and economically) regions. The controversy over biofuel adoption is particularly well suited for the study purposes considering it presents polarized opinions from its advocates and critics. Moreover, it is an issue for which most people have limited access to non-mediated information and one that has gained prominence in the media over the last ten years when alternative sources of energy became a hot topic in the press. Thus, the biofuels controversy provides a way to focus more closely on the relationship between media and science information processing. In doing so, this study does not advocate for an uncritical interpretation of news, but rather investigates how an improved understanding of the news process and its role in society can be applied to improve the work of science press officers and public relation professionals.

1.4   The biofuel case study

In the past decade production and consumption of biofuels have increased considerably, in 2009, global ethanol production reached nearly 20 billion gallons in more than 40 countries (RFA, 2010). A number of private and public organizations have embraced biofuels research and development. Several airlines are researching the viability of blending biofuels with jet fuel with a goal of cutting costs and reducing greenhouse gas emissions (Krauss, 2008). At the same time, biofuels have become more controversial, linked by scientific research and the media to a variety of environmental problems including climate change, water pollution, GHG emissions and water shortages (Abbott et al., 2009;

Englehaupt, 2007; Fargione et al., 2008). Some scholars have argued that replacing traditional gasoline with ethanol can have net negative effects on the environment once indirect land use impacts are taken into account (Searchinger et al., 2008)

Outside of environmental concerns, many have questioned biofuels on ethical and social grounds. Jeffrey Sachs, Director of the Earth Institute at Columbia University and former Director of the United Nation's Millennium Project, has been highly critical of "putting food in our gas tanks" (Melander, 2008). Similarly, United Nations' Special Rapporteur on the Right to Food, Jean Ziegler, called it a "crime against humanity to divert arable land to the production of crops which are then burned for fuel" (Mathews, 2008).

Due to the strong societal need to evaluate and asses the sustainability of biofuels, national bioenergy strategies have been developed, taking into consideration the real potential for bioenergy production, its environmental, social and economic impacts and risks, and encouraging sustainable practices. Biofuels certification schemes are a response to the concerns related to the biofuels sustainability. There are several existing certification schemes related to sustainability, varying considerably in scope, as were developed for a wide range of products as a result of various concerns (Van Dam et al., 2010; BTG, 2008). These schemes include aspects such as land use, agricultural practices, competition with food, energy efficiency and GHG emissions, life cycle analysis (LCA), etc.

Given the social, economic and environmental effects that biofuels have in our society, the debate around this topic currently appears as one of the major controversies in the agriculture/environment news. News reporters gather information about biofuels from a number of mediated information sources, therefore, the extent to which journalists and editors understand the pros and cons of the issue, its benefits and its risks; affects the reporting angles from which news is presented and how much media time and space should be devoted to this topic. Despite the vast amount information and scientific research related to the risks and opportunities of biofuel production, little is known about how this information is being translated into the news and in which way is presented.

The popular press (newspapers, magazines, and increasingly social media such as online blogs) plays an important role in interpreting ideas from the scientific literature and disseminating them to decision makers and the public. Yet some mainstream public media are failing to accurately report the consensus of the scientific community as much as 90 % of the time (Huertas and Adler 2012). The translation of scientific information to the public can involve simplifications, omissions of key caveats and assumptions, or occasional misrepresentations of science (Dake, et.al., 2013).

The second part of this research explores how the media is portraying the sustainability issue of the biofuel production in the news by identifying a set of environmental and socioeconomic topics based on the FAO "Standard for Sustainable Production of Agricultural Biomass" scheme. In this way an analysis on the topics encountered in the media content will be presented to evaluate and reflect on the relationship between the information provided by scientists on the critical sustainability issues of

biofuels and the information presented by journalists on the current debate in the Argentinean and British media.

The bottom line of the discussion will be based on the social and planetary boundary concept (Oxfam, 2012) that sets out a visual framework for sustainable development by combining the concept of planetary boundaries (Rockström et al, 2009) with the complementary concept of social boundaries (Chapter 3). This concept is relevant to the biofuel debate study as includes both environmental and social foundations into the concept of sustainability allowing a reflection which can be compared to the topics identified in the analysis.

1.5   Goals and purpose of the study

This research aims to describe and reflect on how framing analysis can be used as a tool for science press officers to understand the dynamics of scientific news over a period of time. The biofuel debate is a current topic of interest in the renewable energy field being covered in most of the newspapers around the world. Therefore, it offers a great opportunity to investigate how the news media portrays a scientific debate and offers an opportunity to analyze the effectiveness of framing analysis in the context of science news. The focus of this research project is not to debate the pros and cons of biofuel production, but to explore the coverage of the biofuel debate news published in Argentina and the United Kingdom as a case study to describe a framing analysis method.

Secondly, and by embedding an analysis on the coverage of specific biofuel sustainability topics into the framing model, this research aims to contribute with a reflection on how de debate is portrayed in the Argentinean and British news.

1.6   Scientific and practical relevance

As previously mentioned, framing analysis in the context of this research is a useful approach for press officers to understand news processes and effects, but research on news framing has many applications that goes beyond the particular case of press officers.

Public relations professionals play central roles in constructing and using frames in the service of groups and organizations. Hallahan (1999) argued that framing theory provides a rich approach to analyzing what happens in public relations practice and that organizations must develop common frames of reference about issues with the public in order to establish effective relationships with them. In this way, framing research is also potentially useful to support strategic planning by public relations practitioners. In crisis communication, framing analysis can provide crisis managers with useful insights into the appropriate crisis response and strategies to for example minimize the damage to an organization's image.

The following study will also contribute greatly to the understanding of the news media coverage of biofuels. Analyzing how this specific information is being communicated is useful to the different actors participating in the process of dissemination of scientific and technological information, especially public relations professionals in biofuel production companies.

The use of frames in the news for a specific industry or sector can affect business in different ways (Hallahan, 1999). It can be configured by the interaction between a wide range of stakeholders, namely policy-makers, scientists and journalists, along the public and the industry/sector actors. As a new field of interest and investments, the biofuels sector asks for a set of particular public policies to regulate it, to create incentives and/or to draw some limits or restrictions to its activities, the results of this research will as well potentially contribute to evaluation and support of the decisions being made on the bioenergy field.

Furthermore, it is of great interest for scientists to know how the media is representing the biofuel debate and how the sustainability concept is used in relation to the bioenergy issue, if the information presented in the news stories reflects the current research going on in the field and which information has not been incorporated in the news. This research will aim to contribute to a better understanding of the sustainability criteria currently being used in reporting the biofuel issue.

Finally, the results of this study could have implications for future research exploring effective strategic communication, media effects, public opinion, and environmental public policy. Results from this analysis inform readers of prevalent environmental frames and content in science news and also complement the discussion and understanding of media effects and their implications for building framing theory and for informing strategic communication practice.

1.7   Research questions

The goal of this research is to describe a news framing model in order to analyze scientific news content and identify new frames by evaluating how the media is portraying the biofuel issue in the Argentinean and British press as a case study.

The objective is to describe a set of criteria as a toolkit for press officers to help them evaluate the news coverage of a scientific issue over a span of time and improving the communication with journalists. Some sub questions arise from this main goal (Figure 2).

How can press officers use framing analysis as a tool to evaluate the scientific news coverage in order to increase the effectiveness of their corporate messages?

Several questions can be drawn from in order to answer the main research question.

Which are the dominant generic and issue specific news frames that can be found in the biofuel issue news coverage? Are any other frames present in the coverage of the biofuel issue?

Which are the main dominant topics present in the biofuel debate news coverage? Are there new emerging topics related to this subject?

How can framing analysis be used by science press officers to analyse the biofuel debate media content?

Figure 2. Main and sub research questions of the project.

1.8   Report outline

This project is structured as shown in Figure 3. The research started from a **systematic literature review** in order to get a better understanding of the theory underneath a framing analysis study and the state of the art of research related to framing biofuel news, literature review is divided into early conceptions of framing, framing and public relations and empirical research of framing science news.

Following the literature review, the **methods** employed to analyze the biofuel news in the press are described in detail. In chapter 3 the **results** found from the framing analysis are described and follow the research questions stated in the introduction, the description of the framing analysis model is presented in this chapter.

Main **conclusions** about the results are presented on chapter 4 and finally the **discussion** on Chapter 5 gives an analysis and a by reflecting on the implications of the study and discusses recommendations for future research opportunities.

All the relevant data used for this thesis can be found in the appendix were tables detail all the sources of information.

Literature Review

2 What are the theories and previous research behind the study?

Methods

3 How was the study done and what are the steps to follow in order to perform news framing analysis?

Results

4 What were the main findings of this study?

Conclusions

5 What are the main outcomes of the study?

Discussion

6 How can the information found be used and how can the results be applied?

Figure 3. Outline of the Research

2 Literature Review

In order to get a better understanding of the history, theories and concepts underlying the research topic, a systematic literature review was conducted as the first methodological step to build the theoretical framework. The systematic review is part of the methods of this research. On chapter 3 a more detailed description on how the systematic review was done can be found.

In this chapter the theoretical background is described and divided into two main sections:

The first section reviews the theoretical foundation of framing theory including its early conceptual history, typology and framing analysis descriptions. The second part concerns the review of empirical research related to news framing analysis and its applications to the public relations field, the coverage of science news and finally to the specific case of biofuel news in the media. The review of empirical research gathers and describes other news framing studies with a scientific topic involved.

2.1 The theoretical foundation

As previously mentioned, the concept of framing has varied and sometimes inconsistent meanings in the literature. There is a large number of studies covering framing research since early 70's, most of them related to social and political news. This section will highlight and describe the definitions that best suit our analysis in the context of science news.

Defining the concept of framing

Sociologists, communication theorists, educators, politicians, scholars, and others have long been interested in the ability of mass media to shape people's thoughts, attitudes, and behavior. Framing research is a major and fairly recent part of media effect research. Employed widely in television news, framing is also seen in the way the print media repeat or use culturally familiar symbols in a news discourse (Entman, 1993; McCombs and Ghanem, 2001).

The term "framing" has a long history in mass media research, and its meanings have been varied. Semetko and Valkenburg (2000) noticed there is no unique and encompassing definition of the concept, but rather many perspectives that share similar characteristics. In general, however, most framing studies agreed that a frame is

> "A *central organizing idea or story line that provides meaning to an unfolding strip of events, weaving a connection among them. The frame suggests what the controversy is about or the essence of the issue*" (de Vreese, 2005).

The concept of framing has roots in both psychology and sociology and is said to originate from the sociologist Ervin Goffman who discusses framing as an interpretive framework that helps individuals to

process information (Goffman 1974; Pan and Kosicki 1993). Goffman states that individuals cannot understand the world fully and constantly struggle to interpret their life experiences and to make sense of the world around them. In order to efficiently process new information individuals therefore apply interpretive schemas or "primary frameworks" to classify information and interpret it meaningfully.

Framing provides a practical way in which to analyze content for dominant themes or central ideas through an empirical framework. Framing analysis basically allows its user to locate, perceive, identify, and label a seemingly infinite number of concrete occurrences defined in its terms (Goffman, 1974). Goffman's framing analysis provides a general basis for the discovery and interpretation of frames through content analysis. However, his works have been studied by communication scholars who, in turn, have interpreted, extended, and applied his theory.

In 1990 the communication scholar James Tankard approached the concept of frame as "a central organizing idea for news content that supplies a context and suggests what the issue is through the use of selection, emphasis, exclusion, and elaboration." (Tankard, Hendrickson, Silberman, Bliss, & Ghanem, 1991). In order to explain the term Tankard described the frame concept as a picture frame or the framework of a building. According to him, the picture frame stands for the isolation of certain material and the drawing of attention to it. The frame discussed in media studies serves the same function. The shape and color of a frame suggests a tone for viewing the isolated material, which can be a picture, a photo, or any other piece. The same is happening with the framing of messages, where frames suggest a certain way of interpretation. The frame of a house is its organizing and supporting structure. Frames in communications serve as the organizing idea of a message. (Tankard, 2001)

But it is perhaps Robert Entman's work one of the most well-known studies of framing theory. He is particularly relevant to the current study as he broke down the framing theory to apply it to mass media analysis. Since the purpose of this study will be to analyze a science debate in the press, framing will be defined according to Entman.

The definition of Framing (Entman, 1993)

> "To frame is to select some aspects of a perceived reality and make them more **salient** in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described".

In Entman's definition, the word salience means making a piece of information more noticeable, meaningful, or memorable to audiences. An increase in salience enhances the probability that

receivers will perceive the information, discern meaning and thus process it, and store it in memory (Entman, 1993). Frames therefore, work to enable some ideas to stand out in texts, others less so, or others even entirely invisible (Entman, 1991).

Entman elaborated by saying that frames can have different functions, such as defining problems, diagnosing causes, making moral judgments, or suggesting remedies.

In addition to the functions frames have, Entman also identified that frames have at least four locations in the communication process (**Figure 4**): the communicators (for our case. the science journalists) who "make conscious or unconscious framing judgments"; the text (or news story) which may or may not contain a certain frame; the receiver (or the online or offline audience) who reads the newspaper and whose conclusions after reading or being exposed to the news story may or may not reflect the story's frames; and finally, the culture in which both the communicator and the receiver live and exchange meaning (Entman, 1993).

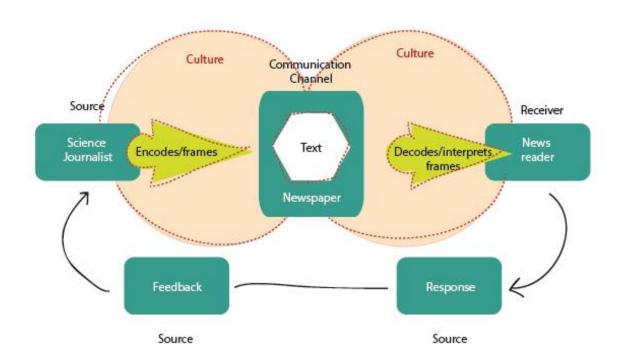**Figure 4**. Communication process scheme, the red dotted line shows where frames are located (adapted from Entman, 1993).

This research will focus its attention on the frames that journalists consciously or unconsciously use in a news text about the biofuel debate, in other words, the interest will be only in one part of the communication process which entails the message presented in a communications channel.

When focusing on the message or the structure of a piece of text, other scholars have expanded upon the concept of media framing. Pan and Kosicki (1993) stated that each news item has a theme that structures it. This theme connects different semantic components of a story into a coherent whole (Pan and Kosicki, 1993). Pan and Kosicki referred to these themes as the "frames" due to their structuring function. Pan and Kosicki (1992) also pointed out that "frames are negotiated and framing involves interactions between texts, text producers, and audience members operating in the environment of various social influences". These two views about framing are particularly relevant to the idea of media effects, as they assume that there is a cause-effect relationship between journalists' framed stories and the audience's interpretations of those news stories.

Mass media scholars have long argued that it is important to understand the ways in which journalists framing of issues occurs because such framing impacts public understanding and, consequently, policy formation. A frame functions to affect the audience's perceptions of topics or issues by addressing certain values, considerations, or facts with more obvious relevance to the topic than they might have under another frame (Scheufele, 2000). Scheufele also suggests that framing is based on "the assumption that subtle changes in the wording of the description of a situation might affect how audiences think about issues".

By synthesizing a quarter-century of framing research Scheufle identified four framing processes: (a) "frame building," which focuses on the dynamics of how speakers, such as media outlets, choose specific frames in communication; (b) "frame setting," which concerns the influence of frames in communication or frames in thought, and the precise psychological processes at work; (c) "individual-level effects of frames," which refers to the impact of frames in thought on subsequent behaviors or attitudes; and (d) "journalists as audiences," which looks at how citizens' actions affect the initial frame-building process.

The aim of this research will be to identify those frames chosen by media outlets when reporting or communicating a scientific debate, so the focus of the study will be the "frame building" process. The other three framing processes are closely related to frame building but use other concepts as foundation, for example the agenda setting concept.

Agenda setting and second agenda setting are related to the "frame setting" process. While agenda setting addresses the salience of issues through examination of the coverage and placement of news events, second-level agenda setting is concerned with the salience of issue attributes (McCombs et al., 1997). Second-level agenda setting refers to the tone of news coverage and attributes given to issues or individuals. The emphasis given to the specific attributes within news coverage connects this theoretical work to framing theory. McCombs (1997) stated that "framing is the selection of a restricted number of thematically related attributes for inclusion on the media agenda when a particular object is discussed".

Frame typology

Many scholars have offered different classification categories in order to understand frames and frame types. Identifying the types of frames helps the researcher to make better decisions based on theoretical evidence when conducting a framing analysis so the results obtained are clear, consistent and replicable. This section will describe the frame typology found in the literature.

- Iyengar and Simon (1993) distinguish between episodic and thematic frames. The episodic frames refer to the coverage of an event or issue, which is reported as specific or particular, whereas the thematic coverage places the event in somewhat general context.

- Scheufele (1999) suggests two kinds of frames "media frames that are characteristics of the news text, and individual frames that are mentally stored principles audience members use for information processing. These two types of frames can be examined either as a dependent or as an independent variable. This study focuses on media embedded in news texts and positions media frames as independent variables previously identified.

- De Vreese (2005) described that certain frames are pertinent only to specific topics or events. Such frames may be labeled as issue-specific frames. Other frames transcend thematic limitations and can be identified in relation to different topics, some even over time and in different cultural contexts. These frames can be labeled as generic frames.

- Semetko and Valkenburg (2000) identified a set of generic frames: 'conflict', 'human interest', 'attribution of responsibility', 'morality' and 'economic consequences'. The conflict frame emphasizes conflict between individuals, groups, institutions or countries. The human-interest frame brings a human face, an individual's story, or an emotional angle to the presentation of an event, issue or problem. The responsibility frame presents an issue or problem in such a way as to attribute responsibility for causing or solving to either the government or to an individual or group. The morality frame interprets an event or issue in the context of religious tenets or moral prescriptions. The economic consequences frame, finally, presents an event, problem or issue in terms of the economic consequences it will have on an individual, group, institution, region or country. Constantinescu and Tedesco (2007) expanded on the five generic frames presented by Semetko and Valkenburg (2000) by asserting that three macro frames exist: metacommunication, speculation and cynicism.

It is important to have in mind when doing a framing analysis that some types of frames can overlap with each other and also different frames can be found in the same piece of news.

Using framing analysis to explore the content of science related news in the media is a new approach therefore there is still no specific typology used to analyze scientific issues. Historically, most of the research related to news framing analysis deals with social and political issues. To analyze the biofuel

debate in the press the researcher must build its own set of frames by relying on previous literature and knowledge on the topic. This study combines two different methods to analyze news content; the multi-method has been accepted as a promising approach in communication research for generating hypotheses and advancing theory (Lim and Jones, 2010). The set of generic frames previously operationalized by Semetko and Valkenburg (2000), a set of issue specific frames used in previous studies to that will be described later in Chapter 3, and a finally a list of topics related to the biofuel debate from the "Standard for Sustainable Production of Agricultural Biomass" (Ismail, et. al., 2011).

By using a combined approach it is possible to compare the effectiveness of each of the different types of frames and additionally have more detailed information about what specifically are the news talking about. The aim is to draw conclusion on what is the better approach when analyzing the biofuel specific case. However, by using the proposed typology it is more difficult to reflect and compare with previous studies with a different set of frames.

Framing analysis

The frames used in a message can be detected and studied through framing analysis. In mass communication research, framing analysis can be located somewhere in between discourse analysis and content analysis, usually combining qualitative and quantitative methods (Neuendorf, 2002).

There are two ways to approach framing analysis. Framing implementation, which is when information is put into a text. Authors apply frames to their messages and texts to deliberately guide the reader's interpretation. This is a very subtle and powerful way to influence an audience. On the other hand media researchers are taking the approach on framing from the opposite end. They try to decode the frame that has previously been applied to the message by the author. After finding certain frames, researchers can draw conclusions on what the author wanted to convey, how he wanted to convey it and what his intentions for doing so might have been. Once the intention for a certain way of framing has been detected, media researchers can also look at its actual impact or perception on the audience. Thus, they can decide whether the frame was successful or not.

In general terms framing analysis studies can be divided in two distinguishable categories: Media studies in which media content is the subject of inquiry, and audience or "interpretative" studies in which a message recipient's schema or framework for understanding messages is the subject of inquiry (de Vreese, Peter & Semetko, 2001). Media framing studies examine manifest content resulting from the construction of mediated messages. This line of research looks at message characteristics, such as the types of appeals used in mediated messages. This thesis is a media content framing study. As such, this study was informed by media content framing studies rather than audience framing studies and will be limited to evaluate the frames found in the news.

Previous literature also identified inductive and deductive analysis as two approaches used to examine media content (Semetko & Valkenburg, 2000). If a researcher uses an inductive analytic approach to

study media content, the researcher approaches the media content without categories or with loosely prescribed categories for identifying content. The goal of inductive analysis is "to attempt to reveal the array of possible frames" that exist in mediated messages (Semetko & Valkenburg, 2000). Such an analysis allows researchers to account for manifest message content that might not be examined in previous research. In contrast, deductive analysis adheres to prescribed framing categories established by previous research (Semetko & Valkenburg, 2000). Deductive analysis uses categories prescribed by previous research as a basis to examine manifest media content. Such an analysis allows researchers to compare results with previous research findings to build a body of knowledge.

This study uses both deductive and inductive analytic approaches. A previous set of generic frames were identified, in which coders are given prescribed variables in a codebook. However, and for the specific frames and topics some emerging frames appeared as analyzing the content which were not previously established.

2.2   The empirical dimension

Framing and public relations

Public relations practitioners occupy positions ideally suited for framing issues in a way likely to advance both public and organizational interests. Their traditional roles as media and community liaisons offer opportunities for framing issues of interest, as do their less-recognized roles as lobbyists, negotiators, and environmental scanners. Several studies have offered guidance about how practitioners at either the interpersonal or mediated end of the continuum can construct frames to accomplish their objectives. The recommendations apply to three general areas of practitioner responsibility: organizational communication, external communication and production of media. (Knight, 1999)

Hallahan (1999) identifies seven distinct types of framing applicable to public relations. These involve the framing of situations, attributes, choices, actions, issues, responsibility, and finally news. According to Hallahan, framing also implicitly plays an integral role in public relations. If public relations is defined as the process of establishing and maintaining mutually beneficial relations between an organization and publics on whom it depends, the establishment of common frames of reference about topics or issues of mutual concern is a necessary condition for effective relations to be established (Hallahan, 1999).

Frames often present alternative representations of a reality. According to Hallahan (1999), storytelling is the most complex form of framing and involves identifying key ideas and incorporating narrative techniques to support the key ideas. For the most part, frames have been studied in the context of mass media, where journalists use familiar themes or frames to introduce new information

(Hallahan, 1999), but they do not overtly use frames to persuade audiences. However, researchers have suggested a prominent role for framing within public relations. Public relations practitioners have the ultimate opportunity to frame issues in a mutually beneficial manner for their organization and its publics. Message framing is useful for public relations practitioners not only for generating external messages but for communication within the organizational itself (Knight, 1997).

Maintaining a positive relationship with journalists and media contacts has become a critical issue for public relations practitioners. Larsson (2009) suggests that despite the diversity of the profession, all practitioners "inform, tip and give suggestions or perhaps the most common one – that they deliver ideas for news – as part of their work". Despite the interdependent relationship, many journalists perceive practitioners to be deficient in journalistic standards and practices (Sallot & Johnson, 2006). Practitioners can improve their journalistic knowledge by using framing analysis to understand both the content and the dynamics of the news.

Research has identified several behaviors that practitioners can use to become trusted sources. The most basic behaviors include providing journalists with useful information, responding to inquiries in a timely manner, and making themselves readily accessible to media outlets (Callison & Seltzer, 2010). Ledingham and Bruning (2009) stress that providing follow-up information to stories and interviews is a key strategy to gain journalists' trust as is sharing information concerning future plans. By adopting a journalist's orientation, including how they write, what interests them, and what beat they cover, public relations practitioners are more likely to be successful with their media relations efforts (Pang, 2010).

Framing scientific issues and debates

The topics of news framing studies have spanned a wide range of issues. Even though most of the framing research has been related to social and political issues, other framing research has focused on the media's portrayal of scientific issues and processes (Nelkin, 1987). Nelkin (1995) noted that while scientists were often concerned about the accuracy of news coverage, overtones generated within news about scientific issues, ideas, proposals, institutions and individuals were also important. He explained that science and medical news reporting inevitably fostered and 'environment of suggestion' about the subjects, persons and issues that journalists covered.

Framing is still considered in a young domain compared to other communication theories since it emerged during mass communication's contemporary fourth era of meaning-making theories and media effects. Many researchers have applied numerous frames to the study of the media. Some of the recent framing studies on science topics include Nisbet (2009) who stated, "Framing offers a powerful theoretical tool for understanding the communication dynamics of science debates and the relationship to public opinion, media coverage, and policy decisions". He argued that scientists must deliberately frame issues in a way that connect with diverse audiences. In doing so, he developed a

reliable typology of frames for science based on past science-related policy debate research, which was originally captured by sociologists Gamson and Modigliani (1989) in their nuclear energy research.

Nisbet's frame typology for science include, debate: social progress (quality of life, solving problems, harmony with nature, sustainability); economic development/competitiveness (economic investment, market benefits/risks; local, national, or global competitiveness); morality/ethics (right/wrong; respecting/crossing limits, thresholds, or boundaries); scientific/technical uncertainty (expert understanding; what's known and unknown, invoking or undermining consensus, sound science, or peer-review); Pandora's box/runaway science (precaution in face of possible impacts or catastrophe, science as out-of-control, Frankenstein's monster including potentially fatalism, i.e. action is futile, path is chosen, no turning back); public accountability/governance (science in the public versus private interest, ownership and control, responsible use or abuse of power, majority versus minority opinion); third way/alternative path (possible compromise position, middle way between conflicting views or options); and conflict/strategy (science as a game among elites, who's ahead or behind in winning, battle of personalities or among groups.

Nisbet (2009) believes that his frame typology for science debate can be used in framing research to enhance awareness about interactions between audience dispositions, and the role media and scientists play in communicating highly contentious scientific and environmental issues. This scholar's examination of frames may prompt new developments about public engagement in critical issues like climate science.

Framing research related to environmental topics includes issues such as climate change (Trumbo, 1996), cold fusion (Lewenstein, 1994) and ozone depletion (Litfin, 1995). While little research has been conducted on media cover of the biofuel issue, scholars have investigated how the media have framed other environmental issues.

Sengers Et, al (2010) analyzed the resistance to sustainable energy technologies by analyzing shifts in media discourse looking to media coverage on biofuels in the Netherlands between 2000 and 2008. The quantitative analyses revealed the dynamics in the content of media discourse, but also its underlying structure finding two opposite socio-cognitive frames: 'techno-economic vs. social–ecological' and 'regional vs. global'.

Wyne and Reid (2011) identified and analyze the media's portrayal of the recent movement to increase U.S. biofuels' investment and development. Using a frame analytic approach they analyzed a dataset comprised of New York Times articles focusing on both the content of frames and strategies used by media claims-makers to assemble frames. Three distinct frames were identified in their study identified: economic development, environment, and national security.

Researchers examined environmental news content in other countries. Dirikx and Gelders (2009) analyzed Dutch and French newspaper articles from four newspapers focusing on climate change.

Researchers examined the prevalence of generic frames (Semetko & Valkenburg, 2000) in the newspaper articles. Results indicated that news articles covering climate change focused on frames of consequences and responsibility. The consequences frame was the most prevalent frame. Articles presenting the consequences frame frequently discussed "the consequences of the (non-) pursuit of a certain course of action and of possible losses and gains"• (Dirikx & Gelders, 2009). The second prevalent frame was the responsibility frame, in which articles discussed "the need for urgent actions, referenced possible solutions and suggested that governments are responsible for and/or capable of alleviating climate change problems" (Dirikx & Gelders, 2009). The conflict frame and the human interest frame were the least prevalent frames according to the study. Data regarding the morality frame were not reported because of inconsistency (Dirikx & Gelders, 2009).

Gordon, Deines, and Havice (2010) analyzed newspaper coverage of climate change in a Mexico-city based newspaper called Reforma. Researchers examined news articles (N=144) published from 2004 to 2006 to see how climate change was covered. Results indicated that newspaper coverage tended to rely on frames of consequences. Findings indicated an occasional presence of the conflict frame, but the conflict frame was not as prevalent as the consequences frame.

Framing the biofuel issue

Within scientific information shared in the mass media, a field with growing attention is the renewable energy field. Currently bioenergy is seen as one of the key options to mitigate greenhouse gas emissions and to substitute fossil fuels. Large-scale introduction of biomass energy could contribute to sustainable development on several fronts, environmentally, socially and economic. However Large-scale bioenergy production also includes environmental, social and economic risks (Fischer, et.al., 2010).

The term "biofuels" refers to any energy source made from renewable organic matter, including wood and other forest products, plants, human and animal waste, and agricultural crops. However, the term has emerged most prominently within public discourse over fuels used for transportation, such as ethanol and biodiesel (Delshad, et.al. 2010). Despite this controversy and the implications this technology has in our society and environment, there is very little published work specifically exploring the content of the biofuel debate in the news.

Even though research about framing the biofuel debate is scarce, there are some studies that are of particular relevance for this study, because they are concerned with analysis of media coverage of energy technologies. Media coverage concerning nuclear power was hugely susceptible to events (e.g. a meltdown) and attention peaked especially in periods of heavy public concern and criticism (Gamson and Modigliani, 1989; Friedman et al., 1992 and Bauer, 1995). More recently, Alphen et al. (2007) investigated social acceptance of carbon capture storage technologies in the Netherlands by analysing stakeholder opinions and applying content analysis to Dutch newspaper articles. They find that media

portrayal is a balanced reflection of stakeholder views and that even though the positive side of carbon capture storage is more dominant at present, NGO's do find the media to express concerns. Also relevant is the recent contribution by Qu et al. (2009) on how bioenergy is depicted to the public in China via the internet. Through applying content analysis methods on an extensive set of articles from Chinese energy web platforms, they found that mainly positive aspects and advantages of biofuels were emphasized.

In relation to the specific biofuel case, a few studies have investigated media coverage of renewable energy technologies. Most of the studies in European countries describe the media as a "watchdog", siding with the public on controversial issues where authorities and industry are adversaries whose interests are questioned by the news media. The term "watchdog" is used when the news media actors' prime rationale is to guard public interest from government or industry abuse, critically regulating public activities (Schultz, 1998). An alternative view is the "lapdog" image of the media. Here, the media are submissive to the interests of governments or industry (Whitten-Woodring, 2009)

Sengers, et. al. 2010 investigated how biofuel media discourse evolved during the 2000–2008 period in the Netherlands, articulating shifts in content and structure of the biofuel discourse and exploring how this affected biofuel practices. Their study highlight that Dutch newspapers amplify voices of organized resistance against new developments, and those groups of protesters can successfully use the newspapers to get their message across to the public. Similarly, Wurstenhagen, et. Al. (2007) claim that the media are increasingly picking up on and communicating local resistance to wind power developments in Germany. While studying the failed development of a biomass electricity plant in the UK, Upreti and van der Horst (2004) showed how local newspapers frequently amplified arguments about social and environmental risks tied to the plant. It would be expected that at least in European countries, in our case the U.K, the media portrayal of the biofuel debate is framed as "controversial" or "conflictive" giving voice to critics of this technology.

In the literature review no information was found specifically on media portrayal of bioenergy in South America, however, and due to the recent history of biofuel production in Argentina it would be expected a more positive coverage highlighting economic benefits. Since 2007, Argentina has in place a regulatory framework to promote the production and use of biofuels. The main objectives of this framework are to diversify the supply of energy, to become more environmentally friendly, and to promote the development of rural areas (primarily non-traditional production areas), especially in benefit of small and medium sized agricultural producers. The government sees the opportunity for biofuels, especially biodiesel, to reduce growing diesel imports (USDA, 2012).

One example is a study of the New York Times coverage of biofuels, Wright and Reid (2011) show how the technology is subject of ambiguity, portrayed as an economic and climatic miracle in some periods, but with some negative aspects like the competition with food on center stage in other periods.

3 Methods

This chapter describes the methodology used to develop the framing analysis model. Starting from a systematic review to get a deep understanding of the theory involved, the sample collection, selection of frames and finally methods used to analyse the results. Additional information can be found in the Appendix.

3.1   Systematic review

The first part of this thesis started with a systematic literature review. For this study a systematic review is part of the research design in order to gather background information that helps a better understanding and state of the art of the topics involved, concepts and theories used. A systematic review offers the researcher a controlled and replicable way to collect information assuring quality and relevance and avoiding bias. The systematic review included three main topics: Framing theory, Framing for Public relations and Framing the science news.

The systematic review started with a general search through different databases (Web of Science, Scopus, Google Scholar and Scirus) to identify the main studies related to the topics and to get familiar with the concepts and theories.

For each topic a set of questions and keywords for search were established in order to guide the identification of literature to be used (Table 1). Keywords must be present in the title, abstract or list of keywords of the study when possible. Relevance and quality of the studies encountered were taken into account to include or exclude the literature to be used. Articles in press, reviews, and editorials were excluded as well as articles not published in peer-reviewed journals. Peer reviews articles and books were included. Google Scholar, Scopus, Web of Science and Scirus were the databases used to look for literature. For each set of keywords the first 20 results organized by relevancy were listed, after that, articles not relevant to the topic were removed from each list. For each topic all articles selected were reviewed and when needed articles referenced within the content found were also added. Studies recommended by the experts in the field were also included when necessary. All references cited in the text are included in the reference list, additionally information about searching parameters and articles not included in the reference list but used for the research can be found in the Appendix.

Table 1. Topics, questions and keywords used for the systematic literature review.

Topic	Questions to answer
Framing Theory	What are the main studies and theories describing news framing analysis?
Framing science news	What are the main studies covering the framing of the science news in the media and most specifically the framing of the biofuel debate in the printed media?
Framing and Public Relations	How can Framing theory be applied to public relations?

3.2   Sample

The study examined stories in *El Clarín* and *La Nación* published in Argentina and *The Guardian* and *The Times* published in The U.K. The countries were selected as being two different and contrasting regions (developing vs. developed countries and Spanish vs. English speaking), both within the major biofuel producers in the world. The newspapers were purposively selected taking into account access to online versions, circulation and each pair having different political views. The online LexisNexis news archive database (a frequently and widely used tool in news searching) was used to explore how the biofuel issue was presented the newspapers mentioned except from El Clarin which was not listed in LexisNexis. Instead, the search tool in the website of the newspaper was used.

Argentina

Two newspapers were analysed in Argentina: El Clarin and La Nacion. El clarin is the largest Argentinean newspaper, politically centrist distributing around 270.000 copies around the country. La Nacion in the other hand is the leading conservative newspaper in Argentina being the second largest newspaper with a distribution of 160.000 copies daily.

United Kingdom

For the United Kingdom two newspapers were analysed: The guardian which is a national daily newspaper with a circulation of around 204.000 copies. The Guardian has been known as a left winged publication and it's the second most popular British newspaper website behind *Daily Mails Online*. The second newspaper analysed was The Times, also referred as "*The London Times*", it's a conservative newspaper with an average daily circulation of 393,000 copies.
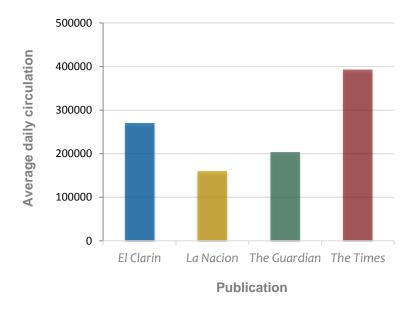
Figure 5. Average daily circulation of the newspapers used in the analysis**.**

Content selection included articles published in the newspapers between the dates January 1st, 2011 to January 1st, 2013 and encompassed news stories as unit of analysis. In terms of types, feature articles, news articles, columns and opinion pieces were included while editorials, letters to the editor, and advertisements were excluded.

In order to explore the selection strategy a preliminary test search database was conducted. A total of 267 news article stories were found when setting the parameters to search for the keywords 'Biofuel', 'Biodiesel´ and 'Bioenergy' for the British newspapers and 'Biocombustibles', 'Biodiesel' and `Bioenergía' for Argentinean newspapers. The search limited the terms to appear in the headlines or lead paragraphs, and restricted to publication dates within the year time period.

After stories were screened for relevance to the study, the search resulted in a total of 125 (n) articles in *El Clarín* (n = 34), *La Nación* (n = 37), *The Guardian* (n=30) and *The Times* (n=24). While results are not generalizable to all newspapers they will provide insight into the major frames portrayed in the stories by media and the players shaping the news coverage of the biofuel topic.

3.3   Coding procedure

In order to assign the different frames to the articles found, the NVivo 9 content analysis software was used. NVivo has been designed for qualitative researchers working with very rich text-based and/or multimedia information, where deep levels of analysis on small or large volumes of data are required This software helps the coder identify the sentences present in the article text that are related to each frame and assign codes for each news item, helping the coder on the storage of the information and further analysis. Additionally it allows obtaining interpretations in forms of tables and

images. Word-clouds and country-comparison graphics present in the results were developed in this software.

Each article was read two times, in the first reading the single coder (the author) established familiarity with the story and recorded the newspaper it was published in, the date of publication, the section and number of words in an Excel sheet. In the second reading, frames and topics were identified according to criteria established in the frame typology and using a predesign codebook (see Appendix). For each article frames were coded as present, absent or dominant. Topics were coded as present or absent.

3.4 Statistical Analysis

Basic descriptive statistics were employed to measure and compare the frequency and dominance of frames and sources. The overall dominance of each frame was measured as the percentage of articles out of the total (n=125) in which a given frame was coded as either dominant or present. These frequencies are presented in the Appendix. Quotations presented in the results chapter serve as illustrative examples, and can be considered representative of a larger empirical body of material. The dominance of sources appearing in coverage was measured as a percentage of the total number coded as "dominant".

3.5 Frames

Semetko and Valkenburg (2000), and de Vreese (2003) mentioned that there were two possible approaches when identifying frames in the news: the deductive and the inductive approaches. The inductive approach starts with an open view and aims to reveal the range of possible frames that emerge from analyzing the sample. The researcher has a very loose representation of the frames to be explored. However, as Semetko and Valkenburg (2000) argued, the inductive approach is very time consuming, often based on small samples, and suffers from replication problems. On the other hand, the deductive approach is based on a pre-defined set of frames. For this study a set of predefine frames was used. The method of analysis of this study is predominantly deductive and used a set of five generic frames operationalized by Semetko and Valkenburg's and a set of four specific frames previously used in similar studies about framing science related issues.

Generic Frames

The set of generic frames follows the study by Semetko and Valkenburg's (2000) in which five generic frames were previously operationalized, this set of frames have been used in extensive framing research (responsibility, human interest, economic consequences, morality, and conflict frames.). This method has been widely used by researchers in communication to explore frames in news reason why

this set of frames was chosen. The following table describes how the generic frames were identified in the text giving some examples of each type.

Table 2. Description and examples of the generic frames used in the analysis.

Frame	Description	Example
◆ Consequences Frame	This frame reports the event, problem, or issue in terms of the consequences it will have on an individual, group, institution, region, or country.	Biofuels as an issue with potentially dire/beneficial outcomes e.g., emphasis on potential impacts - environment, economy, food production, land use.
◆ Morality Frame	This frame puts the event, problem, or issue in the context of religious tenets or moral prescriptions.	Biofuel production as moral/ethical issue e.g., emphasis on risk/responsibility divide between developed and developing world, moral responsibility to future generations or to poor nations who will be affected most.
◆ Responsibility Frame	This frame presents an issue or problem in such a way as to attribute responsibility for its cause or solution to either the government or to an individual or group.	Biofuels as a topic that places responsibility on governments, diplomacy for solutions e.g., what individual politicians, companies, entities are saying/doing, what they should be doing, solutions lie in hands of a party.
◆ Conflict Frame	This frame emphasizes conflict between individuals, groups, or institutions as a means of capturing audience interest.	Biofuel production as matter of dispute/controversy between groups or individuals. Biofuels as matter of political strategy/conflict e.g., between politicians/politicians versus NGOs.
◆ Human Interest Frame	This frame brings a human face or an emotional angle to the presentation of an event, issue, or problem.	Focuses on "human face" or human interest in Biofuels.

Specific Frames

Additionally a second set of technical or issue specific frames were also identified. Having a set of specific frames gives a better and deeper understanding of the coverage. This set of frames is based on previous studies found about framing scientific topics in the systematic review. Studies included framing analysis related to biofuel (Delshad and Raymond, 2013) nanotechnology (Anderson, Allan, Petersen, & Wilkinson, 2005), plant biotechnology (Nisbet & Huge, 2006) and climate change (Boykoff and Boykoff, 2007). Table 3 describes the set of specific frames used for the analysis.

Table 3. Issue specific frames description

Frame	Description	Example
✳ **Economical**	This frame highlights the economic gains or lost related to the topic.	Biofuels bringing opportunities and/or costs to economies presented by policy measures to foster production or use. Special attention to numbers related to exports and imports
✳ **Environmental**	Text that focuses on the impact that the issue has over the environment.	Biofuels impact on the loss of or change in populations of plant/animal biodiversity on the planet or a changing physical landscape to the Earth.
✳ **Technological**	Frame that focuses on scientific progress related to the topics	Biofuels as a scientific/technical issue, a matter of scientific expertise e.g. focus on novel new research, research methods, "what is known vs. unknown", emphasis on authority of scientists, experts.
✳ **Political**	The government as a key player influencing the issue. Laws and new measures implemented.	Biofuels as matter of political strategy between politicians.

3.6 Topics

Engineering and regulatory activities surrounding biofuels are often evaluated in terms of their social and environmental sustainability, technical and financial efficiency, democratic legitimacy or some combination of these factors (Thornley et al., 2009a, Turcksin et al., 2011 and Tyner et al., 2010). A series of certification schemes in order to evaluate those criteria have been established for the production of biofuels in different countries.

As stated in the literature having a mixed approach (Frames + topics) In this research a series of topics were also analysed and identified as "present" or "absent" in the news in terms of social and environmental sustainability. The topics were based on the "Standard for Sustainable Production of Agricultural Biomass" (Ismail, et. al., 2011) document developed by The Council on Sustainable Biomass Production (CSBP), a multi-stakeholder organization established in 2007 to develop a voluntary sustainability standard for biomass production and conversion to serve as the foundation for an independent third-party certification program.

The reason behind analysing topics, as well as illustrating more specific content in the biofuel news can be used as a way to evaluate how the standard criteria for biofuel producers are reflected in the coverage of the debate and which topics are receiving more attention form the media.

The following table describes each of the topics:

Table 4. List of topics used to analyse the biofuel news in the Argentinean and British media.

TOPIC	EXAMPLE
Environmental Topics	
Land-use changes	How biofuel is affection directly on inderectly land use
Biodiversity and ecosystem services	Effects on conservation or enhancement of biological diversity, in particular native plants and wildlife.
Productive capacity of land	Soil quality, erosion, carbon sequestration, effects on biological systems and chemical and physical properties of soil.
Crop management and agrochemical use	Application of pesticides on biomass crops.
Water availability and quality	How biofuel production effects on surface water, groundwater and aquatic ecosystems.
GHG emissions	GHG emissions as compared to fossil-based energy

Air quality	How biofuel production affects the quality of the air
Waste management	Biofuel productiona in relation to the management and disposal of wastes
Environmental sustainability	Information on biofuels and its relation to natural vegetation cover, rare species and communities, existing wildlife habitats and aquatic ecosystems, and past and current land and water conservation activities.
Socio economic topics	
Access to water and other natural resources	How biofuels affect the acces to natural resources of people leaving in surrounding areas.
Employment, wages and labor conditions	Fair treatment of workers on biofuel production companies.
Human health and safety	Ensuring that human rights and abor laws are respected in biomass production fields.
Good management practices	Integrated resource management plans and land management actions.
Food security	Food availability, access , utilization, stability and security.
Governance	How employees and relevant contractors are able to demonstrate working level awareness and knowledge of the laws, statutes, and regulations that apply to their ownership/leasehold and operations.

3.7 Intercoder reliability

A second coder was used to test the reliability of the data; this person had a previous training on how to code the data. The coder assigned frames and identified topics for 10% of the overall sample. To ensure that the level of agreement between the two coders was not by chance, the entries coded were subjected to Holsti's intercoder reliability test (Gerbner and Holsti, 1969), a widely used method in communication research.

The reliability is calculated by:

Reliability = 2M/(N1+N2) Where M=number of coding decisions were the two coders agree and N1 & N2 = the number of coding decisions by the first and second coder respectively.

2(73)/96+96 = 0,8666666

Reliability = 86,7%

3.8 Limitations

Given the relatively short time spam of the study, the results cannot in themselves be considered representative of all the biofuel coverage in the British and Argentinean press. Nonetheless, the time frame is appropriate in fulfilling the aim of presenting an analysis of recent coverage of the biofuel debate in the two countries selected, and in expanding upon previous work.

A further degree of "researcher bias" may have been introduced in this analysis given that all the coding was carried out by a single coder (the author) (McComas & Shanahan, 1999). However, for the 10% of the articles analysed a second coder was used in order to state the reliability of the coding.

4 Results

This chapter presents the findings of the framing analysis of the biofuel debate coverage in *El Clarín*, *La Nación*, *The Guardian* and *The Times*, published between January 2011 and January 2013. After excluding duplicate articles, articles not related to the biofuel debate, and articles out of the targeted time period, a total of 125 news stories remained for analysis. Between the time period, 34 news stories were used from *El Clarín*, 37 from *La Nación*, 30 from *The Guardian* and 24 from *The Times* (Figure 6).
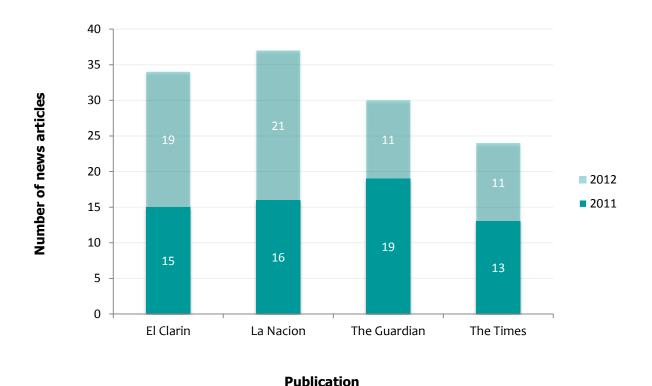
Figure 6. Number of articles per year per publication about the Biofuel debate in Argentina and the U.K from 2011 to 2012.

4.1 Frames

The first research question asks which of the generic and specific frames can be found in the news articles about the biofuel debate. After coding the data all of the generic and specific pre-defined frames were found in the articles, some of the frames presented a high dominance and others were almost not used. A detailed description of the frames is presented. .

Generic frames

The five generic frames by Semetko and Valkenburg's (2000) (responsibility, human interest, consequences, morality, and conflict), defined and operationalized for the first time in their study on "Framing European Politics" were identified in the news data (see Codebook in Appendix 1 for operationalization). The research question asked which of the five generic frames emerged from the biofuel debate online news' as dominant. As Figure 7 illustrates, of all the generic frames the most frequently used in all newspapers was the "consequence" frame with 66,4% followed by "conflict" with 17,6% while the least employed frame was "morality" with 2,4%.
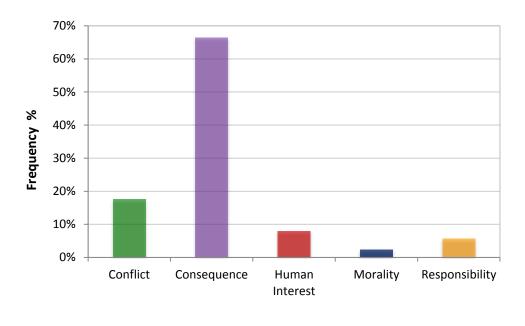
Figure 8. Bar graph showing overall percentage frequency of each frame, and the proportion of instances in which the frame was dominant in the coverage of the biofuel debate in El Clarín, La Nación, The Guardian and The Times between January 2011 and January 2013 (n = 125)
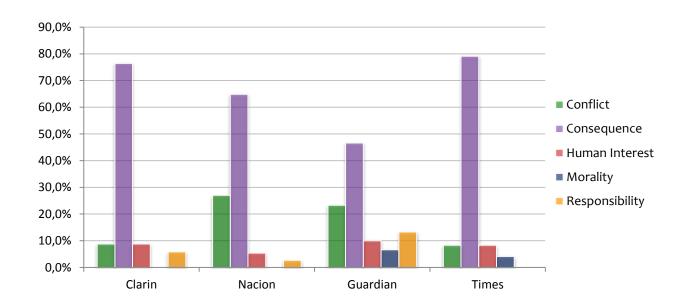
Figure 9. Bar graph showing the frequency of each frame in the different news sources between January 2011 and January 2013.

4.1.1.1   Consequence frame

The Consequence frame generally discussed the potential benefits or harms that the biofuel production/use has. Within the benefits it included general references to biofuels as a "cleaner fuel" source that can help alleviate the GHG emissions problem, a source of economic growth to a country or connects biofuels to the decrease of consumer costs particularly fuel/energy costs. Negative consequences include environmental or social problems caused by the biofuel production and/or use such as food security problems, GHG emissions, land use and employment.

'Greenhouse emissions from vehicles could be reduced significantly by replacing diesel and petrol with biofuels, if these can be produced from algae using renewable and nuclear electricity, said Professor Sir David King.' The Times, August 2011

'In 2011, there will be a decrease in the consumption of biodiesel from the European Union. It would be the first time it happens, after strong growth in recent years. The high vegetable oil prices, coupled with the limited supplies of raw materials, make the use of biodiesel unprofitable' El Clarin, June 2011

In all publications the Consequences frame was dominant in more than 40% of the articles analysed. The Times was the source which used this frame the most with 79,2% followed by El clarin with 76,5%, La Nacion with 64,8 and The Guardian with 46,7%.

4.1.1.2 Conflict frame

The conflict frame describes de biofuel debate by emphasizing a conflict between two parties or groups who are in disagreement. The on-going debate lies over the harms and benefits of the production and use of biofuels. Criticism comes from environmental organizations stating the potential damages to the environment and food security problems. On the other side government parties in general are in favour of producing biofuels as a source of economic growth and encourage its use for transportation fuel.

The conflict frame was the second dominant frame in all publications with 17,6% being La Nación the newspaper that used the most this frames in its articles with 27,03%, followed by The Guardian with 23,3% and The Times and El Clarín with 8,3 and 8, 8 respectively.

'Kenneth Richter, of Friends of the Earth, called the original Virgin flight a "gimmick", distracting from real solutions to climate change. "If you look at the latest scientific research, it clearly shows biofuels do very little to reduce emissions," he said.' The Times, October 2011

'Friends of the Earth claimed that biofuel production was "wrecking rainforests, pushing up food prices and causing yet more climate-changing emissions". However, the aviation minister, Theresa Villiers, defended the sector's use of sustainable biofuels.' The Guardian, March 2011.

4.1.1.3 Human Interest Frame

The human interest frame puts a 'human face' to the story presenting de biofuel production from a personal angle. In general this frame came from stories of people affected by the production of biofuels especially in developing countries.

'Mhaga has no electricity, and water has to be carried each day from a well several kilometres away. "Water is everything," says local activist Halima Ali, sitting with three of her children on the earth floor of their home.' The Guardian, October, 2012

This frame was found dominant in 8% of the overall articles.

4.1.1.4 Responsibility frame

The responsibility frame highlights a specific person/party/institution as the main responsible towards solving a problem related to biofuels. In this case it was generally referred as government measures or specific politicians making decisions related to biofuel regulations.

"Agricultural food-based biofuel is an aberration. We say that the EU and US should put money behind the right biofuels." The Guardian February 2012

It was present in 5,6% of the articles analysed. The Guardian was the source that used more frequently this frame with 13,3% followed by El Clarin with 5,9% and La Nación with 2,7%. The responsibility frame was not found in news stories from The Times.

4.1.1.5 Morality Frame

The Morality frame was the least prominent frame in the sample, consisting just 2,4% percent of the total frames coded. When the frame was identified, it was often evoked in an emphasis on the problems that biofuels has in the society.   Moral and ethical considerations of "fairness" were emphasised as the justification for why biofuels should not be adopted as a fuel solution.

'The legal requirement to put biofuels in petrol and diesel sold in the UK and Europe is unethical because their production violates human rights and damages the environment, a major new inquiry has concluded.' The Guardian, October 2011

The morality frame was used by British newspaper with 6,7% for *The Guardian* and 4,2% for *The Times*. No morality frame was found on the Argentinean publications.

Specific frames

Pre-determined specific frames closely related to the biofuel issue were coded as present or absent, the following graph describes the results found. The economic frame was the most used and was present on 61,90% of the overall articles followed by the environmental frame with 17,46 % and the technological frame with15,87%. The political frame was the least used with 3,17% (see below).
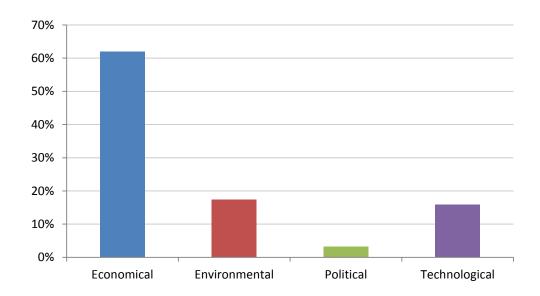
Figure 10. Bar graph showing overall percentage frequency of each frame, and the proportion of instances in which the frame was Dominant or Present, in coverage of the biofuel debate in El Clarín, La Nación, The Guardian and The Times between January 2011 and January 2013 (n = 125)
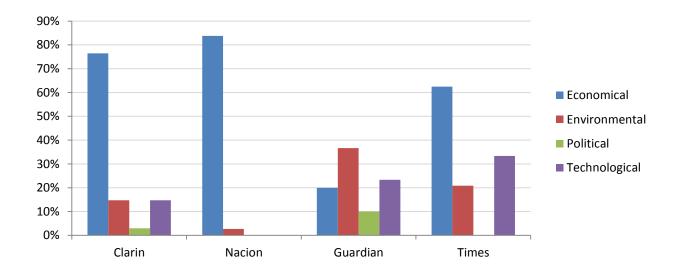
Figure 11. Bar graph showing the frequency of each specific frame in the different news sources between January 2011 and January 2013.

4.1.1.6 Economic frame

In general, the Economic frame was used through an emphasis on the potential opportunities and/or costs to economies presented by policy measures related to biofuel production. It highlights numbers

related to exports and imports of biofuels between different countries. This frame was the most dominant of the specific frames in the overall news stories with a 66,4% of use.

"The million cubic meters of biodiesel consumed in the domestic market in the last twelve months resulted in savings of 1,000 million in imports." El Clarin April 2012

'This week, the European commission will fan the flames with a proposal that will tear through the biofuels industry, effectively ensuring the decline of a European sector estimated to be worth €17bn (£14bn) a year. Industry associations say millions of pounds of investment could be wasted in the UK alone.' The Guardian, February 2012

From all the specific frames the economic was the most used with a 61,9% of frequency. Argentinean newspapers had the higher presence of the economic frame, La Nación was the source that used more frequently this frame with 83,8% followed by El Clarín with 76,5%.

4.1.1.7   Environmental Frame

The environmental frame refers to the potential consequences that biofuel production/use has over the environment. Of special attention was the effect it has on GHG emissions and land use in developing countries. It was found both benefits and harms to the environment as a consequence from the production/use of biofuels.

'The use of biofuels results in less environmental pollution and, therefore, they are undoubtedly highly desirable alternative to delay the depletion of fossil fuels and diversify energy sources.' El Clarin August 2011

' Many studies have now shown that existing biofuels, such as petrol substitutes produced from corn or diesel replacements from soya or palm oil, are actually worse for the environment than petrol, once you have factored in all the fertilizers, processing and transport.' The Guardian October 2011

British newspapers used the environment frame more frequently than Argentinean newspapers. The Guardian used this frame in 36,7% of the articles followed by The Times with 20,8% while El Clarin and La Nacion had 14,7% and 2,7% frequency respectively.

4.1.1.8   Technological frame

In articles evoking the technological frame biofuels were largely presented as a "scientific" issue in which the expert authority of scientists and academics was emphasized. The Science frame was commonly found in articles presenting new research and findings related to new biofuel production ways or uses in transportation technologies.

"The desert plants used to distil tequila could cut emissions from transport by providing an important biofuel crop, according to new research." The Guardian July 2011

"Now researchers are developing ways to turn the sugars and starches it contains into cost-effective biofuel to replace conventional diesel and petrol from fossil fuels and green fuel made from land crops." The Times February 2012

The technological frame was found in 26, 2% of the overall news stories. The Times presented a 33,3% of frequency, followed by The Guardian with 23,3% and 14,7% for El Clarin. This frame was not found in La Nacion.

Comparison between countries

The following figure illustrates variety in the use of the specific frames in the different newspapers. Different colours represent the different frames used, figures shows that British news presented a higher variation in the use of specific frames.

4.1.1.9 Argentinean news

4.1.1.10 British news

Figure 12. Difference in use of specific frames by the newspapers in Argentina and the U.K.

4.2 Topics

The second research question relates to specific topics related to the biofuel debate. News articles were coded for presence and absence of the topics described on the methods and based on the study document for "Standard for Sustainable Production of Agricultural Biomass" (FAO, 2011)

Environmental topics

Within environmental topics the most commonly used was the GHG emissions being present in 25,4% of the overall articles. A total of 32 articles place attention on the relationship between biofuel production and the reduction of emissions especially in the Argentinean news. Other topics such as environmental sustainability, climate change, certification schemes and biodiversity and ecosystem were found in the news but with lower presence with 9,5%, 7,1%, 5,6% and 6,3% respectively.
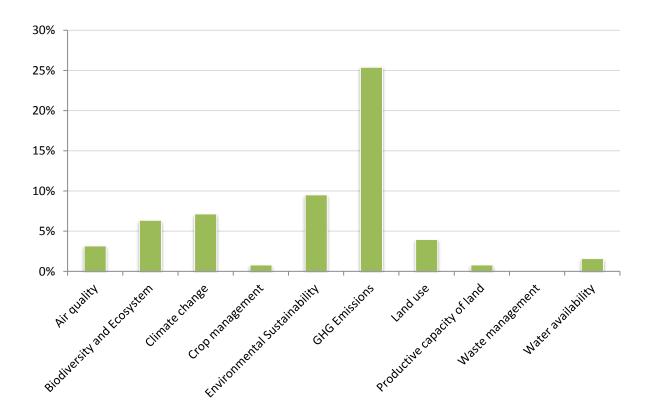
Figure 13. Frequency of appearance of environmental topics in the overall newspapers

El Clarin

La Nación
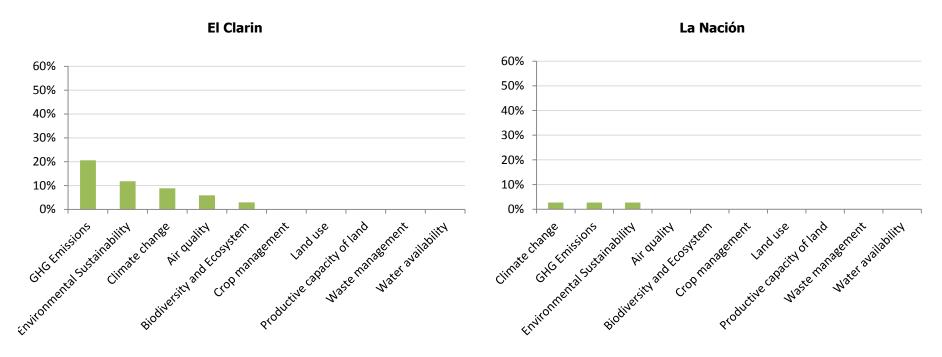
Figure 14. Frequency of appearance of environmental topics in the Argentinean newspapers

Figure 15. . Frequency of appearance of environmental topics in the British newspapers

Socio-economic topics

Regarding the socioeconomic topics the food security debate was found in a total of 23,8% of the overall articles. It is important to highlight that this topic was mentioned in more than half of the news published in *The guardian* and in 29,21% in *The Times.* A contrasting presence in relation to argentinean news were little attention was placed in this topic. No single mention to the food security issue was found in *La Nacion*, and *El Clarin* mentioned the issue in 17,6% of the news items.
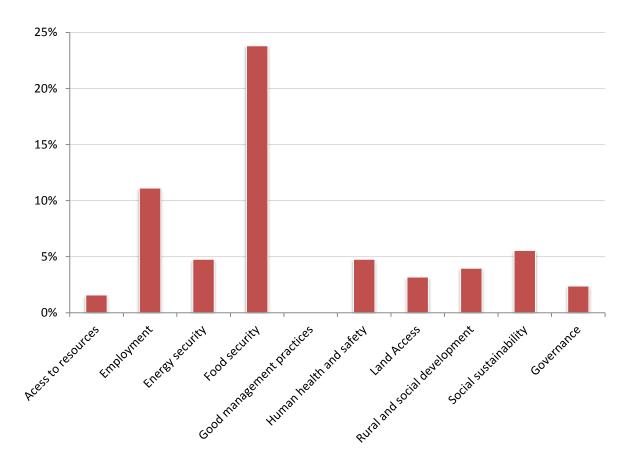
Figure 16. Frequency of appearance of environmental topics in the overall newspaper

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4.2.1.3 Argentina

El Clarin

La Nación
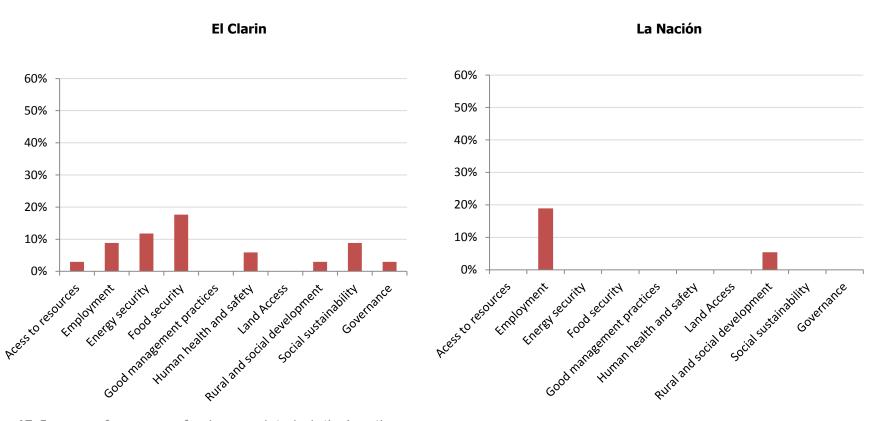
Figure 17. Frequency of appearance of socio-economic topics in the Argentinean newspapers

4.2.1.4   United Kingdom
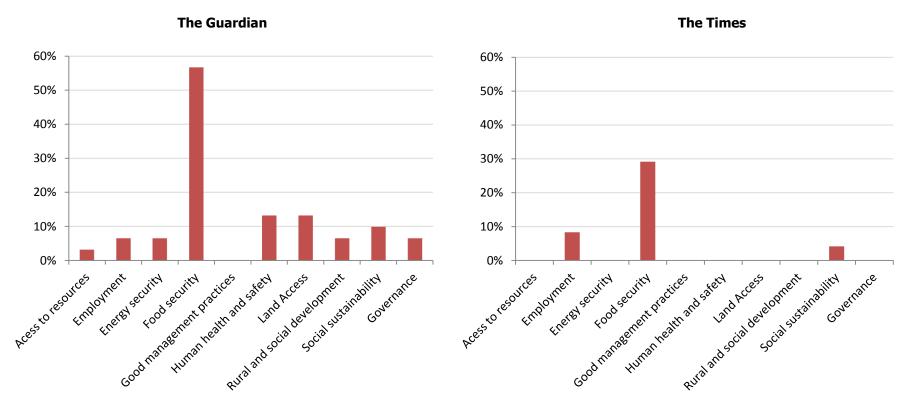
Figure 18. Frequency of appearance of socio-economic topics in the British newspapers

Analysis of word content

In order to visualize the verbiage in the content of the articles analysed, word clouds are shown below comparing the four different newspapers.

Figure 19. Word clouds for the most used words (of more than three letters and excluding "biofuel" and "biofuels") present in the articles related to the biofuel debate in Argentina and the United Kingdom. Upper left (El Clarin), upper right (La Nacion), bottom left (The Guardian) and bottom right (The Times).

4.3 Framing as a tool to analyse media content

As evaluated by previous researchers and by analysing the results of the biofuel news published in Argentina and the U.K, it was found that framing analysis is a useful tool for science press officers to get a general understanding of media content in a period of time. The results revealed that press officers can use this method to both improve their knowledge on how media covers a specific science topic, in this case the biofuel debate, and also improve their communication with journalists by understanding what are the covering and in which way. However it is important to notice that framing analysis has also some disadvantages and problems that have to be taken into account and expand on future research. On Chapter 5 a detailed discussion on the uses and limitations of this tool will be found.

The picture below shows an overview of how the different generic frames, specific frames and topics found in the coverage of the biofuel debate are related to each other. The picture was created taking into account the frequency and the dominance of each frame, as well as how the topics appeared in relation to each of the frames.
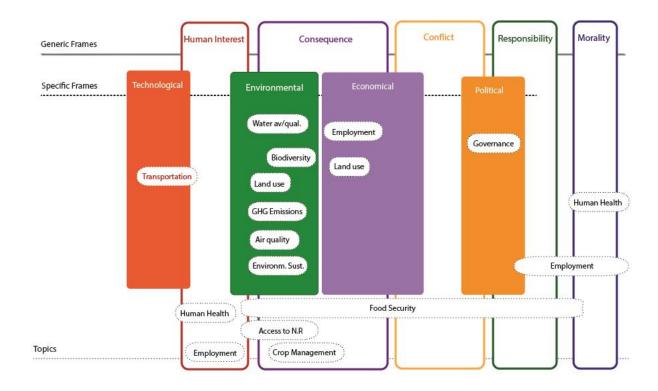
Figure 20. Overview of the relationship between generic frames (Valkenburg, 2000) specific frames (Delshad and Raymond, 2013; Anderson, Allan, Petersen, & Wilkinson, 2005; Nisbet & Huge, 2006 and Boykoff and Boykoff, 2007), and topics (Ismaeli, et al., 2011) found in the coverage of the biofuel debate in the Argentinean and British press.

Despite the limitations that framing analysis has when approaching the coverage of a science debate, the use of a combined method in this case offers potential results if it is applied taking into account some key recommendations. The following section summarizes and describes the steps followed by the researcher when the combined method was implemented for the biofuel case. The model proposed aims to provide a methodology that science press officers can apply for their own purposes and is based on the theoretical background constructed by the systematic review described in the methods, and the empirical findings by the researcher when analysing the specific biofuel news case. As mentioned this model describes the specific biofuel case, in consequence further investigation is needed to extend this method for other science issues.

Framing analysis step by step

1. **Setting the goal**

Framing analysis can be a time-consuming process, it involves reading and re-reading. Knowing specifically what to find out will help stay focused in the analysis. Having a clear and specific research question and possible hypothesis helps the practitioner find better results. The first step of this framing analysis model is to identify what is the question that the press officer wants to answer. E.g. what frames are present in the biofuel debate in the last two years? What are the differences in frames between x and y media? How a magazine is using a specific frame? How dominant is a specific frame in a blog?

2. **Selecting the sample**

After defining the question the following step is to select the sample to analyse, this means choosing the specific data to evaluate in order to have a manageable set of items to analyse and go to the process of reading and categorizing. Newbold et al. (2002) states that selecting the sample comprises:

- Selection of media forms: *What is the source?* (newspapers, magazines, radio, blogs, film, etc.)

- Selection of the period of time: *What period of time is going to be measured?* (a minimum of a month is recommended)

- Sampling relevant content from within the media selected: *How is the sample going to be selected?* *

*The simplest form of selecting the content for analysis is a census – i.e. selection of all units in the sampling frame. This provides the greatest possible representation. However, a census may not be possible in some cases – e.g. where a large volume of media coverage has to be analysed

such as a study over many months or years. In such cases, a sample of media content may be selected.

3. Collecting the sample

Media content can be collected in different ways; items can be downloaded manually from online media sites. However, it should be noted that online editions often do not contain all printed content – e.g. special supplements and sections may not be available online.

Online news services are available, for this case the Lexis-Nexis database was used. It should be noted similarly that some of these services often provide a narrow sample of media content, usually from major newspapers only.

4. Selecting the frames

As described in the theoretical background, framing analysis can be conducted in a deductive or inductive way. This model suggests the practitioner going for a deductive approach by using a predefined set of frames. The deductive approach has the advantage to be faster and easily replicable. For the specific biofuel industry, frames identified in this research can be applied and in this way reducing the amount of time consumed for the analysis. An overview of the frames in the biofuel debate is shown in **Figure 20**. However, and for other issues or science topics, it is recommended to review relevant empirical research to select the set of frames to be identified.

In addition to the frames, topics or specific issues can be also evaluated. For the biofuel case and aiming to analyse the way media is portraying the biofuel debate in the framework of sustainability, a set of topics were identified following the "Standard for Sustainable Production of Agricultural Biomass" (FAO, 2011)

5. Building the "Coding List"

Building a coding list helps to have a clear description of the variables to be used and have a conceptual definition of each. This case used the generic set of frames described by Valkenburg and a set of specific frames found in previous research. It is important to make sure there are meaningful differences between rating categories or frames. Fine distinctions between categories or ratings cause confusion and make results unreliable.

6. Coding the data

There are two methods for recording coding:

- The electronic way: For this model and for faster results it is recommended to use specialized software such as NVivo or QDA Miner Lite. In these digital content analysis systems, the Coding List is usually contained in software menus or screens and coding data may be entered directly into a computer system. Additionally these softwares offer the practitioner

automated visualization of results, word counts, graphic comparisons and tables. More information can be found at http://bama.ua.edu/~wevans/content/csoftware/software_menu.html

- The manual way: Some coders still prefer the 'paper coding' (i.e. writing coding on to the articles or transcripts or recording coding on a coding form attached to the text.) 'Paper coding' data is later entered into a computer system for analysis.

7. . Analysing the results

Interpret and report your findings. This can be done with standard statistical analysis as in this case (frequencies of dominant frames and issues) and with the help of software. Graphs (word clouds, frame relationships) give the practitioner a better looking on how the results are represented.
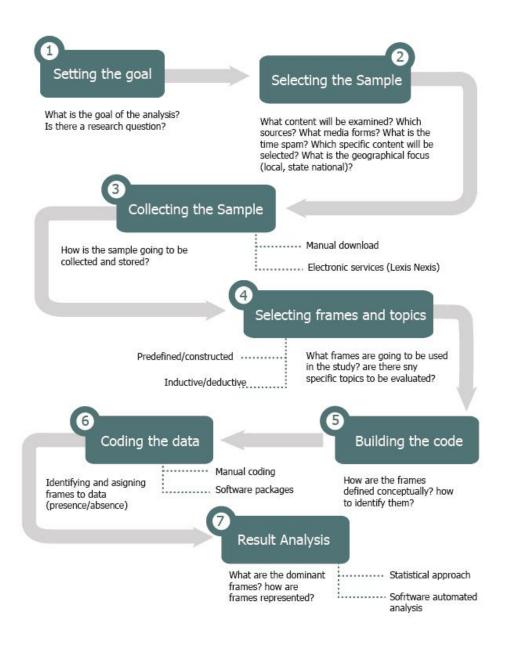
Figure 21. Step by step diagram showing how to perform a combined framing analysis method. The diagram summarizes the steps used by the researcher for the biofuel case debate in the Argentinean and British Press.

5 Conclusions

From the research findings, a number of conclusions might be drawn in relation to the usage of framing analysis as a method to understand media; both in terms of its contents and in terms of its structure and also the applications of framing analysis for the Public Relations field.

- The "consequence" frame was found to be dominant in the news coverage of the biofuel debate in both countries, specifically the "economic" one. Other frames appeared in the news and deserve special attention such as the "environmental" and "technological" due to its implications in the industry and the sustainability issue. Other frames appeared in the news but with very low frequencies such as the "morality frame and the "responsibility" frame.

- Two topics emerged as frequent in the news: The Food security topic in relation to the social aspect and the GHG emissions topic in relation to the environmental aspect. Most of the remaining topics analysed appeared with very low frequencies and some others did now even appeared in the samples. Results confirm that today the debate about the link between food, environment, and biofuels continues. Even though governments (both national and transnational such as the EU) are investing resources into the development of environmental sustainability criteria for biofuels. Newspaper coverage is not reflecting the concerns this standards raise on topics different than emissions and food security. Hence, while newspaper coverage on biofuels appears to keep on discussing the debate, there are indications the newspaper analysis should continue in other arenas.

- Press officers can use framing analysis as a way to understand the biofuel debate in the media. Results gave insightful clues on how this scientific issue is covered and portrayed. However the classical way of categorizing the news was not as informative itself without analysing specific frames and topics in relation to a particular issue over time. Moreover some difficulties arose when using this method. Further research is needed on how framing analysis should be used for science news specially in relation to the ways that the analysis can be applied for the public relation field and the understanding of the dynamics of the media and its implications for public perception.

6 Discussion

This study aimed to evaluate the coverage of the biofuel debate in the context of science press officers by analysing the media discourse present in four newspapers in Argentina and the United Kingdom. More specifically, the goal of this research was to investigate how framing analysis, a concept broadly used for social and political news, can be used to get a deeper understanding of a scientific issue, in this case the biofuel debate media discourse, during 2011 and 1012 in two contrasting countries. Moreover the study aims to explore how this methodology can be used to improve the science press officer work. Results found provided interesting and interpretable insights. The following discussion will expand and reflect on the answers for the research questions established in relation to generic and specific frames, topics and the potential use of this methodology for science press officers. Additionally some implications, limitations and future research recommendations will be described.

6.1 The coverage of the biofuel debate

As a general finding, the results of this analysis revealed a low coverage of the biofuel debate in the four newspapers (125 articles in two years) when compared to other environmental issues such as climate change that have received extensive attention in the media with almost a thousand articles in the same spam of time. This reveals that even though the renewale energy field is a topic of interest for governments, scientists and the public, the attention has not been reflected consequently in the media.

Biofuel related news in Argentina where higher in numbers than in the U.K and the space dedicated to the news section was also longer. Articles in El Clarín had the most number of words with articles having 600 words on average. It was also observed that Argentina even have special suplements exclusively dedicated to the issue such as the ieco supplement of El Clarin, where extended analysis of the topics are given from an economical point of view. A possible explanation on this phenomenon is the recent development in the biofuel production of this country for the past five years, when the capacity of biofuel production expanded in more than 400% (Rozemberg, et. al., 2009).

6.2 The frames found

Despite the controversial characteristics that the biofuel debate presents, having polarized opinions with advocates and critics on different sides, it was the "consequence" and not the "conflict" frame the most used generic frame in the news analysed in both countries.

In Argentina the "consequence" frame appeared in more than 60% of the stories, journalists in this country portrayed the debate highlighting the positive economic consequences that biofuel brings to the economic grow of the country, reflected on the prevalence of the specific "economic" frame. In both newspapers more than 70% of the news presented the economic aspects of the debate. Bioenergy was praised as a green technology that has brought prosperity to the country and a potential source of income, particularly in rural areas. Stories often dealt with particular production companies focusing on progress, growth of a "bio-economy" and biofuel as a business. This phenomenon reflects the on-going incentives for production in the country. In Argentina, and as previously mentioned in Chapter 3, regulatory frameworks and incentive by the government promote the production and use of biofuels.

The "consequence" frame was also found dominant in the U.K, however, and by observing the presence of specific frames the British press gave more balanced views on the specific consequences involved, especially *The Guardian* which presented the higher percentage of "environmental" frames giving voice to biofuel critics that presented the negative consequences of the production and use in the south. British news supported what found in previous research on the portrayal of the debate in other European countries where media can act as a "watchdog" guarding public interest from industry abuse.

Two generic frames presented low appearance in the news with less than 7 articles using them. The responsibility and the morality frame. The morality frame was used in only 3 articles, all of them in the British news. These stories were related to the poverty topic raising the issue of the human rights problem in relation to the biofuel production in developing countries. The Responsibility frame which assigns responsible entity to a problem was only found in 7 news stories. With almost all the results embbeded in the "consequence", "conflict" and "human interest" frames, the specific set of of frames became crucial to be able to understant how exactly the biofuel issue was portrayed and finding the main differences between the countries.

6.3   Differences between countries

Eventhough media attention to the biofuel debate was higher in Argentina, the way the news stories portray the debate had striking differences between the two countries. Argentinean news show that biofuel production is important for the economy of the country and ignore the potential negative consequences of the production of this fuel. The british press on the other hand specially *The Guardian*, offered a more heterogeneus coverage of the debate giving space for discussion on several fronts and informing the public using several frames and topics.

When comparing the frames of the biofuel debate between the two countries it is evident that there are striking differences in the ways journalists are portraying the issue. Stories from Argentina published in both *El Clarin* and *La Nación* newspapers focus the attention and frame the debate mainly

on the economical aspects of the biofuel production and the benefits that this fuel has for the development of the country. Even though the consequence frame was the most used frame in both countries the argentinean press highlights the positive consequences and portray biofuel production as good or beneficial for its society placing an empazis on biofuels as a source of employment for small production companies and soy growers. Little space and attention was given to analyse the potential harms that biofuels could bring to the environment, land use and food security.

The british press on the other hand showed more varied news and topics related to the debate and attention was placed on the pottential harms that biofuel production has on land use, poverty and food security as seen in the topic results. In terms of sources, *The Guardian* referenced studies from Oxfam as other suorces of information and opinion pieces were found around the ongoing debate.

Another difference found in the portrayal of the biofuel debate news was the global vs. local approach in terms of content. Argentina in one side presented news about local problematics focusing on the political and economical situation of the country while in the U.K bioenergy was related to a global issue. Moral debates about the relationship between the North and the South and about links between food and energy production were found in the British press.

The previously mentioned differences are of great importance for press officers. Knowing how this specific issue is being portrayed in these two countries helps building more effective press releases by targeting specific media outlets depending of the region.

6.4   Topics

In order to get a deeper and better understanding on what specific themes were covered within the mentioned frames in the Argentinean and British press, a list of topics were analysed in the news samples. These topics have a close relation to the biofuel issue since are listed as criteria for a sustainable biofuel production. The sustainability concept used to reflect on the results found, lies on the social planetary boundaries conceptual framework developed by Oxfam in 2012. This framework highlights the interconnectedness of the social, environmental, and economic dimensions of sustainable development .Therefore it allows to elucidate and reflect upon the way the press presents the biofuel debate as a sustainability issue.

Results of the analysis show an unbalanced and low coverage of the topics in both countries, especially in Argentina.

In terms of socioeconomic topics the food security issue was found to be the most present topic with 23% of frequency, however it only represents 30 articles of the overall sample and most of the appearance was found on the British news. Argentina had only 6 stories covering the issue and only in El Clarin. The rest of the socioeconomic issues analysed had very low presence and some of them were completely absent in the overall news such as access to resources and good management practices. The low attention placed on the socioeconomic impact of the biofuel production supports

the necesity to include social factors into the sustainability standards but also to promote them. Oxfam stated that bringing global resource use back within planetary boundaries is critical for sustainability, but this must not be done in ways that push people further below the social foundation (Oxfam, 2012). "Biofuel production has been achieved at the cost of exacerbating deprivation for millions of people living in poverty. During the food price crisis of 2007-09, biofuel production diverted food crops for use as fuel, significantly pushing up food prices. Planting crops to produce biofuels has also been a major driver of largescale land acquisitions in developing countries. In many cases, biofuels companies have taken control of the land and water that marginalised agricultural communities, particularly women farmers, depend upon for their livelihoods" (Oxfam, 2012).

The situation of the environmental topics is not very different, yet the British press had a more critical view covering most of the topics. The GHG emissions factor was the more frequent topic covered. Both countries used the GHG emissions topic into their stories with more than 20% with the exception of La Nacion with less than 10%.

One of the principal reasons for switching to biofuels is that they should have a negative GHG balance, i.e. offer emissions reductions compared to fossil fuels. If this criterion is met, biofuels will be a useful tool in the fight to avoid dangerous climate change. However, some recent studies have suggested that the indirect effects of biofuels production, such as higher food prices, could encourage farmers to clear forested land to grow more crops—thereby worsening climate change. The suggested positive impact that biofuels have on emissions reduction was the most used argument in favour of the production and use but little attention was placed on the indirect effects. As for the remaining topics and as similar to the socioeconomic content, a very low appearance was found with less than 10% of the overall news articles covering them. Topics such as crop management, land use and water availability highly discussed by researchers were absent in the Argentinean news.

The above mentioned results in the Argentinean news confirmed what Massarani (2007) found on her analysis of the science news in Latin America. She discussed that in this region there is an emphasis on the benefits of science rather than its risks. In addition she found that the presence of questions related to scientific controversies – an important aspect in the dynamics of the scientific process – was low. Moreover, the uncertainties and risks also had little emphasis in the stories she analysed and stated that "the journalism practiced in Latin America is still poorly critical toward science and its role and impact on society".

The unbalanced coverage of topics has implications for policy makers because the media is not reflecting the importance other social and environmental factors have in the regulation of the production of this fuel and that promotion and attention on this concern should be then the focus of attention. Additionally it can be suggested that the established scientific process of disseminating new information via peer-reviewed literature is not an effective way to inform policy and society about bioenergy sustainability, nor is it designed for that purpose. Scientists who are conducting analyses

meant to inform decisions should be attentive to what they communicate and to whom and should frame their analyses in view of clearly defined policy options.

6.5   Practical implications

Results showed that science news behave differently from political and social news; even though Valkenburg's generic frames provided an overall picture of the intention of the news articles, the use of generic frames without additional specific information does not provides enough information to understand how the news are portrayed and why. Specific frames in this research then became much more important when trying to understand a scientific issue as well as topics related. Some specific frames such as "technological" and "environmental" emerged in both countries and in that way could give the press officer more information about how the biofuel debate is being covered. On the other hand frames that were not used much such as "morality" and "human interest" gives the opportunity to turn the debate into another point of view. This confirms what Goffman stated early in 1974 that frames are not static characterizations but change with time.

It is important then to evaluate how science news behaves differently from social and political news and to understand that a set of frames cannot be applied across all kind of news. New frames should be described and tested to analyse how science has been shown in the mass media.

Additionally, this research revealed that a combination of frames is more informative to analyse the portrayal of a science issue than using a single typology. Generic frames isolated from the specific ones and the topics are not sufficient to draw conclusions and to understand the dynamics of the science debates as in contrast to political and social news. Moreover identifying key topics gives a more in depth view of the content of the news allowing a better understanding of the news.

The use of framing analysis for the biofuel case support what stated in theory that frames are potential ways to analyse media and that public relation practitioners should use them as a way to understand the news. Results allowed to draw important points of discussions and confirmed some of the hypothesis presented in the literature review. However, it is critical to have a previous knowledge of the subject in order to construct specific frames and to build a set of topics to identify. Public relations practitioners with a specific background in science would be able to be more critical toward the findings and be able to obtain more accurate results.

6.6   The use of framing as a tool for science press officers

One of the main outcomes of this research was giving press officers a guide to evaluate science news. The step by step diagram was described for a specific case so it can be used only to evaluate the coverage of the biofuel debate by science press officers in the oild industry. Eventhough it offers potential to analyse other news more information and research is still needed and it should be used carefully to approach other science debates.

6.7   Limitations of the framing analysis model

The used of a combined frame analysis resulted as expected in a useful way to understad the way media is portraying the biofuel debate, the proposed methodology at least for the bioenergy issue gives insightful results and allows the practitioner to focus their messages in a better way but also identify opprtunities in regard of less covered areas of the debate. However there are some limitations hat should be taken into account when using the proposed approach.

Previous knowledge on environmental science was crucial to design and select the frames and topics to evaluate and as well as to draw conclusions on the posible explanations for some of the results found. Practitioners should acquire sufficient knowledge to be able to use the framing analysis and not drawing wrong conclussions.

The combined approach has only been tested in this case for the biofuel debate and the topics have a direct relation to the sustainability issue, reason why it is recommended to be critical when approaching a different scientific topic and using a framing analysis. The same approach cannot be used to analyse other science debates and frames should be selected for a particular case.

This study only evaluated the coverage of the biofuel debate over a span of two years, in order to better understand how this topic is evolving it will be useful to extend the research in time and keep a track of the future news. Additionally in order to analyse media effects on the public content analysis should be done over other sources of information such as magazines, blogs and broadcast media and evaluate public opinion by means of surveys.

6.8   Opportunities for future research

For a better understanding of the biofuel debate, future studies should analyse the presence of frames and issues in different media outlets throughout other countries within the highest biofuel producers and consumers. Furthermore research should incorporate international media regardless the language barriers.

By analysing other scientific topics a "generic" set of frames to evaluate science issues could be designed. This research revealed that the classical Valkenburg's generic frames are not informative enough so to identifying new sets of frames is needed.

This research gave some basic insights in how framing analysis can be used to evaluate science news and provided the most used frames in the press of two contrasting countries; the information described is of great use for press officers in order to get an understanding of the news arena of the biofuel debate in Argentina and the U.K. However there is a need to go beyond theory and description into the practical solutions on how to evaluate coverage in order to be able to see trends and improve the work of communication professionals.

Finally it would be important to analyse how discourses transform at country borders and how these dimensions vary in the case of other new and sustainable energy technologies. Do we find similar dynamics and properties of discourses in other regions? if so, in what ways? The methodology applied in this research might also be used to analyse more elaborately broader (and longer lasting) environmental debates (e.g. sustainability or climate change). Another field of future research would be to combine discourse analysis with social perceptions and evaluate resistance in new energy technology fields.

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Appendix

Table 5. Search settings and keywords for the systematic review, showing the number of hits found per database.

Theme		Scopus	Web of Science	Scirus	Google scholar
	Search settings	Keywords in title, abstract or keywords Only articles or books Organized by relevance	Keywords in topic Only articles Organized by relevance	Keywords in the complete document Only articles Organized by relevance	Exclude patents and cites Organized by relevance
Framing theory	"Framing theory"	151	97		3400
	"News framing"	90	81		3130
	"Media framing"	202	155	582	3140
	"Framing analysis"	132	88	341	1630
Framing and science	"Framing science"	14	31	179	527
	"science news" and media	40	38	435	10200
	Bioenergy and framing	9	45	261	865
	Biofuel and framing	20	36	211	1000
Framing and public relations	Framing and "public relations"	93	76	748	810
	"Framing analysis" and "public relations"	8	58	37	14000
	"Public relations" and "media tools"	11	9	59	446
	"framing" and "press officers"	0	0	7	421

Table 6. Additional articles reviewed but not included in the reference list, articles highlighted in blue have high relevance in relation to the topic.

Framing Theory	Framing and sience	Framing and public relations
Borah, P. (2011). Conceptual issues in framing theory: A systematic examination of a decade's literature. Journal of communication, 61(2), 246-263.	Nelkin, D. (1995). Selling science: How the press covers science and technology (2nd Ed.). New York: W.H. Freeman and Company.	Knight, M. G. (1999). Getting past the impasse: Framing as a tool for public relations. Public Relations Review, 25(3), 381-398.
Bryant, J. (2008). Media effects: Advances in theory and research (Vol. 10). Routledge.	Nelkin, D., & Lindee, S. (1995). The DNA mystique. New York: W.H. Freeman and Company.	Lim, J., & Jones, L. (2010). A baseline summary of framing research in public relations from 1990 to 2009. Public Relations Review, 36(3), 292-297.
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Table 7. Frequencies of Generic & Issue specific frames for Online News Stories by Newspaper and Overall

Frames	Clarín n=35		Nación n=37		Guardian n=30		Times n=24		Overall n=126	
	f	%	f	%	f	%	f	%	f	%
Generic frames										
Conflict	5	14,3%	10	27,0%	11	36,7%	2	8,3%	28	22,2%
Consequence	34	97,1%	32	86,5%	26	86,7%	21	87,5%	113	89,7%
Human Interest	4	11,4%	3	8,1%	7	23,3%	2	8,3%	16	12,7%
Morality	1	2,9%	-	-	2	6,7%	1	4,2%	4	3,2%
Responsibility	2	5,7%	2	5,4%	11	36,7%	-	-	15	11,9%
Specific frames										
Economical	26	74,3%	31	83,8%	6	20,0%	15	62,5%	78	61,9%
Environmental	5	14,3%	1	2,7%	11	36,7%	5	20,8%	22	17,5%
Political	1	2,9%	-	-	3	10,0%	-	-	4	3,2%
Technological	5	14,3%	-	-	7	23,3%	8	33,3%	20	15,9%

Table 8. Frequencies of Dominant Issues for Online News Stories by Newspaper and Overall (N = 126)

Issue	Clarín (N=35)		Nación (N=37)		Guardian (N=30)		Times (N=24)		Overall (N=126)	
	f	%	f	%	f	%	f	%	f	%
Environmental Topics										
Air quality	2	5,7%	-	-	-	-	1	4,17%	3	2,4%
Biodiversity and Ecosystem	1	2,9%	-	-	5	16,7%	2	8,33%	8	6,3%
Certification Schemes	4	11,4%	-	-	3	10,0%	-	-	7	5,6%
Climate change	3	8,6%	1	2,7%	4	13,3%	1	4,17%	9	7,1%
Crop management	-	-	-	-	1	3,3%	-	-	1	0,8%
Environmental Sustainability	4	11,4%	1	2,7%	7	23,3%	-	-	12	9,5%
GHG Emissions	7	20,0%	1	2,7%	17	56,7%	7	29,17%	32	25,4%
Land use	-	-	-	-	5	16,7%	-	-	5	4,0%
Productive capacity of land	-	-	-	-	1	3,3%	-	-	1	0,8%
Waste management	-	-	-	-	-	-	-	-	-	-
Water availability	-	-	-	-	2	6,7%	-	-	2	1,6%
Socio Economic Topics										
Access to resources	-	-	-	-	-	-	-	-	-	-
Employment	3	8,6%	7	18,9%	2	6,7%	2	8,33%	14	11,1%
Energy security	4	11,4%	-	-	2	6,7%	-	-	6	4,8%

Food security	6	17,1%	-	-	17	56,7%	7	29,17%	30	23,8%
Good management practices	-	-	-	-	-	-	-	-	-	-
Human health and safety	2	5,7%	-	-	4	13,3%	-	-	6	4,8%
Land Access	-	-	-	-	4	13,3%	-	-	4	3,2%
Rural and social development	1	2,9%	2	5,4%	2	6,7%	-	-	5	4,0%
Social sustainability	3	8,6%	-	-	3	10,0%	1	4,17%	7	5,6%

Table 9. List of articles on biofuel debate found on Argentinean newspapers between Janury 2011 and January 2013

El Clarin			
Date	**Title**	**Section**	**No of Words**
20.10.12	Al modelo le faltan dólares…	Rural	623
05.10.12	Más maíz… y menos soja	Rural	521
05.10.12	Una estratégica nueva industria	Rural	887
05.10.12	Hay mucha energía en el agro	Rural	630
22.09.12	El biodiesel, fase superior de la soja	Rural	635
20.09.12	Biodiésel: no va más una idea de Kicillof	Politica	635
01.09.12	Europa y el futuro	Rural	141
01.09.12	Las puertas del mercado europeo	Rural	494
19.08.12	Réplica en la OMC por la traba europea a los biocombustibles	Politica	316
17.08.12	Biodiésel, "una industria madura"	Rural	618
11.08.12	Las empresas, alarmadas	Politica	102
28.07.12	La expansión agroenergética	Rural	1009
04.05.12	Los biocombustibles son clave	Rural	663
21.04.12	Fuerte respuesta de Cristina a la represalia de España	Politica	608
21.04.12	Primera represalia española: dejará de importar biodiésel	Politica	520
20.04.12	Primer castigo de España por la expropiación de YPF: frena la importación de biodiésel	Politica	346
16.04.12	Avanza la aviación ecológica: logran volar con biocombustible	Scoiedad	
17.03.12	La soja se va metiendo en el tanque	Rural	408
07.01.12	Otro buen año para el biodiésel	Rural	441
23.12.11	El choclo, bajo la lupa del etanol	Rural	
15.10.11	Si no fuera por el biodiesel…	Rural	
27.08.11	Un tema que se impone	Rural	
20.08.11	Biocombustibles "verdes"	Rural	
26.06.11	Alerta verde para el biodiésel	Rural	
11.06.11	Los "bio" van por más	Rural	
21.05.11	El biodiésel quiere seguir creciendo	Rural	

Date	Title	Section	No of Words
07.05.11	¿En España cierran la compuerta?	Rural	
16.04.11	El BM advierte sobre la suba del precio de los alimentos	Mundo	
16.04.11	El otro mercado de la soja	Rural	
02.04.11	Más "bio" en Rosario	Rural	
01.04.11	Ahora, hay que hablar de la Argentina posible	Rural	
24.03.11	¿Biocombustibles vs. alimentos?	Opinion	
05.03.11	Tenemos que festejar que el campo tenga rentabilidad	Rural	
26.02.11	Cuando todo se transforma	Rural	

La Nación

Date	Title	Section	No of Words
27.12.12	España vuelve a aceptar el Biodiesel Argentino		252
15.12.12	Biodiésel: las petroleras deberán compensar a YPF		932
08.12.12	El Gobierno subió el precio del Biodiesel para pymes las		699
21.11.12	Biodiésel: por los efectos negativos de la intervención, el Gobierno hará más cambios		877
13.11.12	Kicillof y Moreno quieren segmentar el precio del Biodiesel		885
17.10.12	España da marcha atrás con las trabas al Biodiesel		338
02.10.12	No bajaron aún las retenciones al Biodiesel		518
20.09.12	Confirman que habrá retenciones móviles para el Biodiesel		530
18.09.12	Fijarían retenciones móviles en el Biodiesel		368
08.09.12	Buscan aliviar a las pymes de Biodiesel		757
06.09.12	Habría cambios para el precio del biodiésel en el mercado interno		846
31.08.12	Invertirán US$ 1500 millones en plantas de etanol de maíz		346
27.08.12	Presión provincial por el Biodiesel		556
15.08.12	Cierran pymes de biodiésel por la baja del precio		591
14.08.12	Piden negociar por los biocombustibles		475
12.08.12	CRA, contra el alza de las retenciones al Biodiesel		261
11.08.12	Otra jugada de Kicillof		477
11.08.12	Suben retenciones al biodiésel y las descartan para la soja		809
19.07.12	Acusan al país en la UE por dumpingcolor		807
14.06.12	Protesta contra España en la OMC	Financieras	677
29.04.12	YPF obliga al país a pensar en verde	Financieras	897

31.12.11	Podría aumentar el gasoil; Podría haber nuevas subas en gasoil	Politica
18.11.11	Anuncian inversiones en riego rural	Politica
17.11.11	Desconcierto entre las empresas afectadas	Rural
08.11.11	Exportaciones de biocombustibles	Rural
19.10.11	Buscan aumentar el porcentaje de etanol que deben tener las naftas	Rural
15.10.11	Realizan el primer vuelo comercial menos contaminante del mundo	
04.10.11	Empresa Energía Renovable inicia producción de biocombustibles; Biocombustibles	Politica
15.09.11	Invertirán US$ 110 millones para producir etanol a base de maíz	
20.08.11	Productores que se unen por el etanol	Campo
20.07.11	Más inversiones para el biodiésel	Economia
02.07.11	Oportunidad para el bioetanol	
07.05.11	Biodiésel: queja contra España	Campo
06.05.11	Vuelven a parar los trabajadores del gas	Rural
04.05.11	Barreras para el biodiésel	Politica
04.04.11	Cada vez se utiliza más soja para producir biodiésel	Politica
30.03.11	Presidente de Petrobrás ve caída en inversión en nuevos combustibles; Cayó la inversión en nuevos combustibles	Politica

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Table 10. List of articles on biofuel debate found on British newspapers between Janury 2011 and January 2013

The Guardian			
Date	**Title**	**Section**	**No of Words**
16.10.12	Biofuels industry does not deserve to be demonised	Environment	891
14.10.12	New EU biofuels law could be last straw for farmers hit by wet weather and rising costs	Environment	1264
04.10.12	Biofuel production and 'land grab' out of control - Oxfam	International	369
21.09.12	Biodiesel industry dealt a blow by EU policy changes		607
11.09.12	The global land grab is the next human rights challenge for business		889

07.09.12	National: Aviation: Carbon targets: Blue skies and green energy: aviation industry claims more can fly without big rise in emissions	Home	954
04.09.12	US and EU must change biofuel targets to avert food crisis, says Nestlé chief		667
20.08.12	Biodiesel 'falls short of EU greenhouse gas target':	Financial	666
19.08.12	Biofuel fails EU sustainability test, German researchers claim	Environment	670
16.05.12	Only biofuels will cut plane emissions	Environment	
19.01.12	GM microbe breakthrough paves way for large-scale seaweed farming for biofuels	Environment	834
09.11.11	US airlines go green with burger oil and algae fuel mixes	INTERNATIONAL	381
08.11.11	US airlines begin powering flights with biofuels	Environment	574
30.10.11	Eco dream of UK firm wrecks life for African village:	OBSERVER	1640
11.10.11	US must stop promoting biofuels to tackle world hunger, says thinktank	Environment	548
11.10.11	Virgin Atlantic unveils plan to use 'green' fuel	Environment	500
06.10.11	Energy: Greens attack UK's first commercial bio-fuel flight	FINANCIAL	97
05.10.11	Green campaigners condemn Thomson Airways' biofuels flight	Environment	575
15.08.11	US corn-belt farmers: 'The country has turned on us'	Environment	1235
28.07.11	Biofuel researchers toast a new tequila sunrise	INTERNATIONAL	232
19.07.11	Biofuel demand in US driving higher food prices, says report	Environment	569
08.07.11	Lufthansa to become first airline to run regular biofuel flights	Environment	311
21.06.11	Green sky thinking	FINANCIAL	131
17.06.11	Biofuel jet to make first non-stop trans-ocean flight	Environment	446
01.06.11	British firms leading the rush to buy up Africa in biofuels boom	HOME	762
01.06.11	Expert view Tide turns against biofuels as food crisis worsens	HOME	581
13.03.11	Biofuels transport targets are unethical, inquiry finds		798
08.03.11	Shortage looms as drivers shun biofuels	FINANCIAL	389
07.03.11	Biofuel scepticism prompts German summit	Environment	417
27.01.11	Two-thirds of UK biofuel fails green standard, figures show	Environment	581

The Times

Date	Title	Section	No of Words
17.08.12	Bet of the day	BUSINESS	55
04.05.12	Brazilian adventure remains on track after $1.8bn sale	BUSINESS	196
04.05.12	Brazilian sell-off	BUSINESS	91
16.04.12	The name's the same, but the ambition is to grow a giant	BUSINESS	658
29.02.12	Icap	BUSINESS	70
12.02.12	Fill it up on premium seaweed	BUSINESS	
12.02.12	Pay up: £2bn bill for biofuels	Faetures	
15.01.12	Oil firms fined over elusive biofuel		
15.01.12	Petrol suppliers fined for running short of biofuel		
10.08.12	Biofuel quotas prompt food crisis claims		
22.07.12	BP bets on a biofuel miracle	BUSINESS	
05.12.11	Aviation can clean up its own act, Branson insists	NEWS	134
22.11.11	Deal of the day	BUSINESS	56
09.11.11	Arsenal's link to biofuel maker excites investors before kick-off;	BUSINESS	791
04.10.11	Iberia's aviation fuel of the future or flight of fancy?	BUSINESS	
30.08.11	It's a gut feeling, but pandas could help save the planet	NEWS	221
12.08.11	Biofuel made from algae 'could solve energy crisis'	NEWS	404
01.07.11	Now we're cooking: biofuel flight cleared for take-off	NEWS	469
27.06.11	Fly to New York in less time than it takes to watch the in-flight film	NEWS	817
23.06.11	Rice turns to biofuel		81
20.06.11	Green fuel crossing	BUSINESS	67
22.05.11	Biofuel stops farmers being driven bananas		
15.04.11	World Bank warns of threat from biofuels		
12.02.11	Bristol biofuel plant given the go-ahead		