



Selection & Representation of Research in Newspaper Coverage

Dutch newspaper coverage on livestock farming as a driver of climate change 2000-2015

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Preface

In this report I present the results of my Master thesis research. As a student I was taught that research should be theoretically and socially relevant. Hence, I was curious to find out to what extent research actually contributes to our society. This curiosity and my interests in the media and sustainable agriculture led to the research focus you will find in this report. It is based on many hours of work, effort, frustration and inspiration. The research process was challenging. I have learned a lot, and for that I am grateful.

This part of the report provides me with an opportunity to show my gratitude towards people who helped me during the research process. First, I would like to thank Margit van Wessel, Corina van Middelaar and Imke de Boer for their guidance and advice. Furthermore, I would like to show my gratitude towards Dennis Snoek, Theun Vellinga and René Schils for taking the time to talk to me and provide me with valuable insights regarding livestock farming and climate change. And finally, I would very much like to thank Rick, my family and friends for their help, support and understanding.

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Abstract

This study explored the uptake of research in Dutch newspaper coverage on livestock farming as a driver of climate change between 2000 and 2015. The global livestock sector is an important source of greenhouse gas emissions and provides several opportunities for climate change mitigation. Successful implementation of these mitigation options partly depends on societal support. Societal support is assumed to be closely connected to societal understanding. Research can contribute to the societal understanding of livestock emissions by providing information on the current situation, potential solutions and developments. However, the public often does not directly rely on research for their knowledge. Instead, many citizens turn to news media, like newspapers. News media do not mirror objective reality or scientific reality but construct their own mediated reality. In this process they can choose to select research as a source of knowledge to inform their audience. An analysis of newspaper content provides insight into the nature of research selection by newspapers. Moreover, it provides insight into the consequences of this selection for how the newspaper audience has been informed about livestock farming's role in climate change. Yet, Dutch newspaper coverage on livestock farming as a driver of climate change has not been studied before, neither has the uptake of research with regard to this topic. Social problems theory and the theory of framing were used to guide a qualitative content analysis of 162 newspaper articles from the two most-read Dutch newspapers: Telegraaf and Volkskrant. Three experts on climate-livestock research were interviewed to assess whether newspaper coverage mirrored scientific debates. The newspaper analysis revealed that between 2000 and 2015 research has been a prevalent and prominent source of information about the natural, technological and sociological aspects of the issue. Research contributed to newspaper attention, the understanding of the problem in general, the involvement of newspaper readers, the scale of mitigation options considered and the evaluation of these mitigation options. By challenging statements made by other actors research contributed to the assessment of the credibility of sources and introduced complexity and uncertainty into the newspaper dialogue. However, research was not able to settle moral and political discussions about the sustainability of different livestock systems or the need for governmental interference. Moreover, the newspapers excluded some specific research information (e.g. methodological information and uncertainty of research results) and included some incorrect and/or invalidated information. The results of this study suggest that research-media interactions take place to a considerable extent and contribute to the understanding of complex issues like the role of livestock farming in climate change. The Telegraaf and Volkskrant provided their audience with quite a comprehensive and accurate overview of the issue, and used research to do so.

Key words: climate change mitigation, livestock farming, media analysis, framing, agenda-setting, social problems theory, research communication, science communication

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1. Introduction

Background to the study

“Warming of the climate system is unequivocal. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased” (IPCC, 2013, p.2). Climate change is a global problem, affecting human and natural systems worldwide (IPCC, 2014a). This involves changes in water quantity, water quality, and food production (IPCC, 2013; IPCC, 2014b). Moreover, damage caused by droughts and floods to infrastructure, ecosystems and human well-being reveal how vulnerable some regions are to climatic extremes caused by global warming (IPCC, 2014b). Human systems are not only affected by climate change, through the emission of greenhouse gases they contribute to climate change as well. Anthropogenic greenhouse gas emissions are currently higher than ever before¹ (IPCC, 2014a). In response, in all parts of the world people are searching for suitable mitigation options: opportunities to reduce or reverse climate change (IPCC, 2014b). One of these mitigation options is the reduction of emissions from the livestock sector (Steinfeld et al., 2006). According to Gerber et al. (2010) the global livestock sector is responsible for 14.5% of human induced greenhouse gas emissions. However, a 30% reduction of this sector's emissions would be possible (Gerber et al., 2013).

Should the emissions from the livestock sector be reduced? How can we do this? And who is responsible? Technological, social and political innovations are needed to decrease livestock emissions (Gerber et al., 2010). Therefore the role of livestock farming in climate change is not only considered to be a scientific or technological problem, but a social problem as well. How we deal with social problems largely depends on how we make sense of them (van Bommel et al., 2015). This implies that how the role of livestock farming in climate change is understood by society can have serious consequences for technological, social and political innovation. From a communications' perspective it is particularly interesting to explore how different factors influence the understanding of social problems.

Research focus

“We know we have global environmental problems because science documents the existing situation and ever tightens its predictions of future changes. Accordingly, science supplies the knowledge needed to stimulate and guide social-political action” (Taylor & Buttel, 1992, p.405). Several scholars argue that (scientific) research is an important link between actual environmental problems and the perception and understanding of these problems by social groups (Beck, 1992; Boykoff, 2008; Eden, 1996). Accordingly, research could provide knowledge to create public awareness, influence public perception, and stimulate and guide social and political action towards livestock-related climate change mitigation (Beck, 1992; Boykoff, 2008; Eden, 1996; Taylor & Buttel, 1992). Especially in the case of climate change, research seems to be of great importance. Hence, the causes of climate change lack visibility and the consequences of emitting greenhouse gases are distant and complex

¹Anthropogenic (human-induced) GHG emissions in 2010 have reached 49 ± 4.5 GtCO₂-eq/yr, quantified as CO₂-equivalent (GtCO₂-eq) emissions using weightings based on the 100-year Global Warming Potentials, using IPCC Second Assessment Report values (IPCC, 2014c)

(Moser, 2010). This brings us to the first part of this study's focus: the potential contributions of research to the societal understanding of livestock farming as a driver of climate change.

Most Dutch citizens do not speak to scientists or read peer reviewed papers. Instead: *"Millions of citizens turn to the news media daily and 'the media' is a cornerstone institution in our democracies"* (de Vreese, 2005, p.51). Wide scholarly agreement exists about the potential role of news media in creating and guiding societal involvement in climate change (Boykoff, 2008; Lee et al., 2014; Moser, 2010; Schmidt et al., 2013). First, because news media can raise public awareness. For many people the media is an important source of information and therefore it can influence what they think and talk about in daily life (McCombs & Ghanem, 2001). Some scholars refer to this as the 'agenda-setting function of the media' (McCombs, 1977). Furthermore, the media can help people to understand an issue and to form an opinion about it by providing them with information they might otherwise find difficult to acquire, or would not search for in the first place (Almiron & Zoppeddu, 2014; Kleinschmit & Sjöstedt, 2014). Accordingly, media coverage can help people form a political opinion about issues (Scheufele, 2014). The media can highlight a certain understanding of livestock farming as a driver of climate change and with this create societal pressure to deal with this problem in a certain way (Lee et al., 2014; Kleinschmit & Sjöstedt, 2014; Boykoff, 2008). Media do not mirror objective reality or scientific reality but actively create their own reality (Scheufele, 2014; Weingart, 1998). This brings us to the second part of this study's focus: how newspapers select and represent research in their construction of livestock farming as a driver of climate change. In this process (scientific) research can be selected and translated into knowledge in the context of news.

Knowledge gap

The combination of research and the media as a source of knowledge could significantly contribute to societal understanding of livestock farming as a driver of climate change. But how did research contribute to newspaper content? What does this tell us about the link between research and the media? And how does this expand our knowledge about how Dutch newspaper readers have been informed about the issue? This currently remains unknown. In fact, media representations regarding livestock's contribution to climate change have never been studied in the Dutch context before. Pot & Termeer (2010) studied newspaper attention regarding the livestock sector and found an increase in attention to sustainability and the environment between 2003 and 2009. However, this topic was not the focus of their study and therefore it was only covered generally. Moreover, it remains unclear whether this development continued. Almiron and Zoppeddu (2014) studied coverage of eating meat and climate change in Spanish and Italian newspapers but did not focus on other aspects of livestock farming. Lee et al. (2014) studied media coverage with a special focus on the relation between climate change and livestock farming from 1999 to 2010. However, their study was not applied to the Dutch, but the United States' context. Furthermore, none of these studies paid special attention to the selection and representation of research in newspaper coverage.

Purpose of the study & relevance of its results

Therefore this study aimed to increase our understanding of how Dutch newspapers used research to report on livestock's role in climate change between 2000 and 2015. It serves not only to provide insight into the attention to research from newspapers, but the function of research in how the problem was covered as well. This is important, because news media can constitute an important link between research and society with regard to this issue. And although we might depend on science for the identification of this problem, we depend on society for doing something about it. The results of this study are useful for researchers interested in the benefits and limitations of media-involvement, communication experts searching for ways to bridge the gap between science and society, and anyone who wants to know more about how Dutch citizens have been informed about livestock farming as a driver of climate change.

Research questions

This study aimed to answer the following research question: *"How did research contribute to Dutch newspaper coverage on livestock farming as a driver of climate change between 2000 and 2015?"*

The following sub-questions were set up to guide the researcher towards a comprehensive and credible answer to the main research question:

1. To what extent was research about livestock farming as a driver of climate change taken up by the Telegraaf and Volkskrant?
2. How did the Telegraaf and Volkskrant select and represent research to present livestock farming as a driver of climate change?
3. To what extent did newspaper coverage mirror scientific debates on livestock farming as a driver of climate change?

The first question was posed because in order to assess the role of research in newspaper coverage the presence of research within newspaper coverage should be made explicit. Hence, when research does not receive media attention it is unable to contribute to its content. Considering research did contribute to newspaper coverage, the second question was asked to explore how research contributed to newspaper coverage. It focussed on which knowledge was included, how it was included, and why it was included. Although the second question provided insight into research which was included by the newspapers, it did not focus on research which was excluded from newspaper coverage. The third question allowed the researcher to shed light on research results, sources, and discussions that did not make it into newspaper coverage. Hence, it enabled the researcher to explore research on the issue and compare this exploration to the results from the first two questions.

Methodology

This study followed a qualitative content analysis approach. 162 articles from the Volkskrant and Telegraaf were analysed. Additionally, newspaper coverage was compared to scientific debates based on information from a literature review and three expert-interviews.

Structure of the report

This chapter introduced the background and focus of the study. The next chapter will provide more insight into the connection between livestock farming and climate change. The theoretical and conceptual framework applied in this study is explained in chapter 3. The study design, data and methodology are discussed in chapter 4, followed by the research results in chapter 5, 6, and 7. Chapter 8 provides a conclusion and discussion.

2. Life Science Background

This chapter provides background information about the life science aspects of livestock farming as a driver of climate change. It is based on a literature review performed at the start of this study.

Climate change

Several definitions of climate change exist and therefore it is important to clarify what is meant by it in this report. This report follows the Intergovernmental Panel on Climate Change definition: “*Climate change is a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity.*” (IPCC, 2014b, p.5). The sun radiates energy towards the earth, which is partly absorbed by earth’s surface and the atmosphere, and partly reflected directly back into space. Some of this reflected heat is absorbed by the atmosphere and reradiated back to earth, which is called the ‘greenhouse effect’ (IPCC, 2007). Increased concentrations of greenhouse gases intensify the greenhouse effect, causing global warming and climate change (IPCC, 2007). Changes in the composition of the global atmosphere are partly caused by anthropogenic (human-induced) greenhouse gases. Reducing anthropogenic greenhouse gas emissions is possible and important. It can reduce climate change risks, increase possibilities for the development of climate-resilient human systems, and reduce costs of dealing with climate change in the future (IPCC, 2014a).

Livestock farming and greenhouse gas emissions

Livestock farming’s share in global greenhouse gas emissions can be calculated in various ways, depending on what aspects of the production chain are included or omitted. Following Gerber et al. (2013), the global livestock sector can be held accountable for 14.5% of human-induced greenhouse gas emissions. This includes all processes along the production chain (production of energy sources and fertilizers, feed production and processing, enteric fermentation of ruminants, manure management, and the processing and transportation of animal products). About 44% of these emissions is released in the form of methane (CH₄), 29% as nitrous oxide (N₂O), and 27% as carbon dioxide (CO₂) (Gerber et al., 2013; Neeteson & Verhagen, 2010). Animal feed production is responsible for most emissions (45%) and includes practices like crop fertilization and pasture expansion. Enteric fermentation of ruminants (digestion of food by animals like cows and sheep) is responsible for 39% of the sector’s emissions. Manure storage and processing results in 10% of the emissions. The other 6% is emitted during transport and processing of animal products (Gerber et al., 2013). A distinction is often made between direct emissions (e.g. enteric fermentation) and indirect emissions (e.g. deforestation or the production of synthetic fertilizer) (Smith et al., 2014; Steinfeld et al., 2006). Cattle contributes most to global livestock emissions (65%), followed by pigs, buffalo, chickens, small ruminants and other poultry (Gerber et al., 2013).

Mitigation options in the livestock sector

Emissions from the livestock sector can be reduced through supply-side and demand-side changes (Smith et al., 2014). Supply-side mitigation is focussed on reducing production, or decreasing emissions per unit of land, animal, or product (Gerber et al., 2013). According to Henderson et al.

(2011), these mitigation options can be categorized into four groups. The first group includes technical opportunities to increase productivity and reduce the number of animals or land area needed per production output. This includes fertility management, animal health, genetic and nutritional improvements (Gerber et al., 2013; Henderson et al., 2011; Hristov et al., 2013b). The second group is focussed on reduced methane release during enteric fermentation (e.g. through dietary additives) (Gerber et al., 2013; Henderson et al., 2011; Hristov et al., 2013a). The third group is focussed on manure management (e.g. different storage conditions or application/processing methods) (Gerber et al., 2013; Henderson et al., 2011). The fourth group is focussed on improved land-use management, including carbon sequestration (storing CO₂ in the soil) and the production/protection of soil and biomass carbon stocks (e.g. forests) (Gerber et al., 2013; Henderson et al., 2011; Smith et al., 2014). Demand-side mitigation strategies aim to change the demand for animal products and reduce (food) waste (Smith et al., 2014). Consumers can contribute to mitigation through their consumption and political behaviour (Gerber et al., 2010; Smith et al., 2014). They can make sustainable choices when purchasing animal products, and support or protest against mitigation policies and technological developments. Policy options to stimulate mitigation can be focussed on market-based mechanisms (e.g. taxes and subsidies), technological or performance standards (e.g. animal housing standards), or voluntary behaviour mechanisms (e.g. labelling schemes) (Gerber et al., 2010). Furthermore, governments can stimulate/fund research and spread knowledge about mitigation (Gerber et al., 2010).

Mitigation in the Netherlands

In 2014 the Dutch livestock sector consisted of 42.603 farms (CBS, 2015)² with an estimated total production value of 11.310 million euros³ (van der Meulen et al., 2014). Taking into account the expected increase of global demand for animal products like milk and meat (Gerber et al., 2010; Steinfeld et al., 2006), animal production will remain an important economic factor in Dutch society. The size and type of livestock production systems varies across the world, resulting in different emission quantities and mitigation options. Compared to developing countries (e.g. South Asia and sub-Saharan Africa), Dutch and other Western European livestock systems generally have higher production intensities, resulting in lower emission rates per unit of product (Gerber et al., 2013). Furthermore, in these countries beef often comes from dairy farms with low emission rates (Gerber et al., 2013). Nevertheless, various Dutch organisations are contributing to a more climate-friendly livestock sector. Scientific/technological institutes and agricultural corporations are working on the development of new housing systems, increased efficiency, sustainable animal fodder, reduced methane emissions from enteric fermentation, and sustainable energy production (Uitvoeringsagenda Duurzame Veehouderij, n.d.). In 2008 the Ministry of Economic Affairs and several agricultural organisations agreed upon livestock-related climate goals (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2009). This shows that climate change mitigation in the Dutch livestock sector remains a relevant topic.

² Incl. grazing livestock farms, intensive livestock farms, livestock combination farms and crop/livestock combination farms (all types of animals)

³ Based on the production value of intensive livestock and cattle farming.

3. Theoretical & Conceptual Framework

This chapter describes the theoretical and conceptual framework which gave focus to the study and guided the analysis. Paragraph 3.1 provides an overview of theoretical perspectives and previous findings on the connection between science, society and media. In paragraph 3.2 and 3.3 social problems theory and framing are explained. Paragraph 3.4 contains a clarification of key terms.

3.1 Literature Review

Scholars have been studying the connection between science, the media and the public for several decades (e.g. Schäfer, 2010; Summ & Volpers, 2015). Moreover, the existence of scientific journals like *Public Understanding of Science* (since 1992) and *Science Communication* (since 1979) reveal ongoing scientific interest in this topic. Theoretical perspectives from previous studies provide interesting starting points for this study, and will now be discussed. The results of this study are placed back into the theoretical discussion in chapter 8.

Science in society

It has been generally acknowledged that science can play an important role in society, and that it has done so in the past (Scheufele, 2014; Weingart, 2002; Weingold, 2001). Contemporary societies face complex challenges, like climate change, which according to several scholars cannot be sufficiently understood without scientific findings (Scheufele, 2014; Summ & Volpers, 2015; Taylor & Buttel, 1992; Weingart, 2002). Furthermore, scientific breakthroughs, like the identification of anthropogenic climate change, can have, and have had, social and political implications (Weingold, 2001; Scheufele, 2014). Livestock's role in climate change provides an example of a complex challenge with social and political implications. Hence, livestock emissions lack visibility, and the consequences of livestock emissions are distant and complex. The identification livestock farming as a driver of climate change largely depends on scientific findings (e.g. IPCC, 2014, Steinfeld et al., 2006). Nevertheless, these findings have social and political implications: technological, social and political innovations are needed to decrease livestock emissions (Gerber et al., 2013; Steinfeld et al., 2006). Weingart (2002) argues that in face of such issues the borders between science and society/politics become blurred. Political actors use scientific data and scientists appear as political advisors, which Weingart (2002) refers to as the 'scientization of politics'. At the same time, scientific developments with social or political implications are likely to become subject to public debate (Scheufele, 2014), which Weingart (2002) refers to as the 'politicization of science'. Scientific knowledge is judged and evaluated by society (Weingart, 2002), and social actors use and modify it to communicate arguments and suggestions in line with their interpretation of the issue (Fischer, 2003; Pepermans & Maesele, 2014). According to Carvalho (2007), who largely draws upon Beck's *Risk Society* (1992), science is no longer considered faultless and superior, but more often exposed to criticism, contestation and deconstruction. This politicization of science is considered problematic when following a 'linear model of innovation thinking'. In these linear ways of thinking science is viewed as the producer of knowledge, which is transferred by extension workers or the media, and implemented by end users, politicians or the 'public' (Leeuwis & Aarts, 2011; Stone, 2002; Weingart, 1998). Moreover, the politicization of science is considered problematic when one believes that a rationalisation of politics with a clear separation of facts and

political values is most suitable (Stone, 2002). Nowadays more multidimensional ways of technical, social and political innovation thinking are present, in which social context plays an important role. Leeuwis and Aarts (2011) argue that innovation does not only include technical innovations, but new knowledge, modes of thinking, and social structures as well (e.g. perceptions, agreements, identities and social relationships). According to Cash et al. (2002), the transfer of scientific knowledge depends on its relevance, timing, credibility, and legitimacy. Scientific information should be trustworthy, provided at the right time, and respectful to stakeholders' values and beliefs. Based on these findings the transfer of knowledge from science to society cannot be seen as a matter of course. In technological, social and political contexts the transfer of knowledge is complex. Newspaper content provides real life data to explore one of many interactions between science and society in face of anthropogenic climate change.

(Scientific) reality vs. mediated reality

In his view on science communication as political communication Scheufele (2014) describes the 'medialization of science': the notion that science and media are linked into a 'reciprocal relationship'. He argues that media rely on scientific and public scholars for interesting, relevant and credible information on scientific breakthroughs. He also argues that research depends more and more on public and private investments and public support, and therefore has much to gain from media attention. The idea of the media as a link between scientific findings and public perception/knowledge draws on the notion that it is impossible for an individual to pay attention to everything (Scheufele, 2014). The media preselects and distributes information to citizens and therefore influences public knowledge and perception (Scheufele, 2014). In linear ways of thinking, or the 'popularization' perspective, the media is seen as a 'translator' or 'propagandist', transferring (scientific) information to a passive and 'receptive' public (Weingart, 1998). The perspective of popularization has been criticized and replaced by different modes of thinking in which social conditions which are central to social and political processes (reputations, careers, money, emotion, norms, values and beliefs) receive more attention (Leeuwis & Aarts, 2011). The media is no longer seen as a translator or propagandist, but an active institution which creates a 'mediated reality' (Scheufele, 2014). News is created by journalists and editors who interact with their environment; selecting, interpreting and bringing together information they regard worthy enough to be presented to their readers (Scheufele, 2014). In this process journalists are 'gatekeepers' who use their own criteria for inclusion and validation of information (Weingart, 1998). Dunwoody (2008, p.32) argues that reporting on science (and any other type of news) depends on "news pegs": characteristics of the real world that are proven to get attention from the audience, such as timeliness (political or social relevance at a particular time), conflict (discussion/debate), and novelty (new/surprising). News media also diverge from scientific media in terms of structure, audience, organizational factors (financial resources, editorial policies and space provided by the medium) and external factors (accessibility of information and the need to appeal to a big audience with regard to advertisements (Downs, 1972; De Vreese, 2005; Weingart, 1998). Furthermore, the media provides a stage for societal actors with different perspectives and opinions who can indirectly use scientific knowledge to support their claims (Kleinschmit & Sjöstedt, 2014). Gamson (1999) described the media as a 'validator' of claims made by 'primary validators':

social institutions which are considered to have the capability and motivation to produce objective (disinterested) claims about the world (e.g. researchers or governmental (not political) officials). The media does not only spread or report on claims from these primary validators, in the case of socio-political controversies the media decides which institutions are given a voice and to what extent. In this sense media contribute to the translation of claims into 'facts': institutionally validated claims about the world (Gamson, 1999, p.24). These theoretical starting points were considered particularly relevant to this study because they explain why and how mediated reality diverges from (scientific) reality. They sensitized the researcher for what she might find in the study. It remains important to acknowledge the complexity of media influence on public perception, behaviour and policy making (Boykoff, 2011; McCombs 1977). People who do not perceive a topic as relevant or do not feel they have an unwanted lack of knowledge about it will not be very receptive to information presented to them by the media (McCombs, 1977). Nevertheless, news media can contribute to possibilities for public engagement and knowledge. *"Coverage certainly does not determine engagement; rather it shapes possibilities for engagement"* (Boykoff, 2011, p.2; Boykoff 2008).

Findings from previous studies on mediated representations of (climate) science

Various scholars have reported on science coverage in general (e.g. Hijmans et al., 2003; Schäfer, 2010). Others have studied climate change science coverage in particular (e.g. Boykoff & Boykoff, 2007; Carvalho, 2007). A selection of both types of studies was reviewed to provide insight into possible outcomes of the present study. Articles were selected based on their focus on newspapers and the relevance of their findings to research questions 1-3. Hijmans et al. (2003) analysed the representation of science (in general) within Dutch newspapers (incl. Volkskrant and Telegraaf, 2000). They found that 'quality' newspapers like the Volkskrant paid more attention to research than 'popular' newspapers like the Telegraaf, in terms of number and size of articles. Furthermore, they found that many references to research were made in regular news sections, instead of science sections. This corresponds to findings from Summ & Volpers (2015) who studied science journalism in German print media in 2011. They found that journalists used scientific data and findings to discuss social debates and events. These findings are also in line with the 'broader' definition of science journalism as explained by Wormer (2008). In the 'classical' sense, science journalism is focussed on science: institutions, results, and processes (Wormer, 2008). In the 'broader sense', science journalism can expand to sections in the media other than the science section (e.g. news, culture). Science coverage does not necessarily result from scientific breakthroughs or incentives, but may be the result of other (everyday life) developments like climate change or a tsunami. These findings suggest that exclusion of news sections as part of this research could considerably limit its results, excluding many research contributions. Therefore the broader definition of science reporting was used, including all parts of the newspapers and focussing on both natural and social science contributions.

Hijmans et al. (2003) found that newspapers mostly focussed on research outcomes, results and risks, and not so much on uncertainty or methodology. From interviews with journalists, Hijmans et al. (2003) learned that journalists avoid complex information and consider statistics and uncertainty as problematic concepts for readers. This corresponds to findings from Summ & Volpers (2015) who found that in German newspapers science coverage was very affirmative, avoiding scientific

controversies. Hijmans et al. (2003) add that journalists do not refer to many sources to avoid complication of the story. Furthermore, they found that scholars themselves were not often criticized, but did explain, interpret and evaluate parts of the debate, sometimes criticizing politics, business and society in general. Statements from researchers were often found within the newspaper content, but many of them lacked a clear reference: whether the statement came from an interview, speech, or indirectly paraphrased from another document (Hijmans et al., 2003).

As mentioned before, several scholars have studied media representations of climate change science. Weingart et al. (2000) found that in Germany between 1975 and 1995 “the media ignored the uncertainties and transformed them into a sequence of events leading to catastrophe and requiring immediate action” (p.280). In contrast, Boykoff & Boykoff (2007) found that US newspapers and television coverage from 1988-2004 misrepresented scientific perspectives, undermined scientific consensus and overrepresented sceptical perspectives, disagreement and uncertainty with regard to the causes and consequences of human influence on climate change. Carvalho (2007) studied newspaper coverage of climate change in the British ‘quality press’ from 1985-2001 and found variety in coverage between newspapers. The Times and Independent focussed on uncertainty to delegitimize scientific claims and to emphasize uncertainty and disagreement, and to de-authoritative institutions calling for mitigation action. The Guardian and the Independent were found to promote confidence in science and emphasize consensus and credibility of knowledge. These studies suggest that differences exist between countries and possibly between newspapers whether science is constructed as “an authoritative and trustable source of knowledge” or as a “dismissible endeavour” (Carvalho, 2007, p.238). The present study diverges from these previous studies with regard to its focus. Hence, it did not focus on science or climate change in general, but on livestock farming in particular. In addition, it explored whether Dutch newspapers took on an affirmative or critical role towards science on this matter.

3.2 Social Problems Theory

According to Taylor & Buttel (1992) science contributes to our understanding of environmental problems because it documents the existing situation and tightens predictions of future changes. Social problems theory was used in this study because it provides a theoretical approach to look at this potential role of research as a link between what actually happens in the world and our understanding of what happens in the world. Social problems theory is not new. It has been used, discussed and developed since the 1930's, sometimes under a different name like value-conflict theory (Schneider, 1985). Moreover, it has often been linked to other social theories like social imagination and environmental sociology (Bell, 2011). According to Schneider (1985) the central proposition of this theoretical approach is that people create social problems by defining conditions they find troublesome. Social problems are *subjective definitions* about *objective conditions* (Loseke, 2011). Objective conditions are real, tangible or measurable existing conditions in the physical world. Subjective definitions are developed by people to make sense of the world. Loseke (2011) provides four characteristics of social problems. First, the term refers to conditions which are considered problematic and wrong because they create harm. Second, these conditions are widespread, affecting a significant number of people. Third, these conditions are believed to be changeable (they can be

influenced or 'fixed' by people). An fourth, it is believed that something should be done to change these harmful conditions. People do not necessarily worry about objective conditions, for example because they are unaware of these conditions, or do not perceive these conditions as 'wrong' (Schneider, 1985, Loseke, 2011). Causes of climate change lack visibility and the consequences of emitting greenhouse gases are distant and complex (Moser, 2010). Nevertheless, it is important to act upon these changes to prevent and limit harm from happening. Therefore it is important to translate these objective conditions into subjective definitions. This brings us back to the main focus of this study: the role of research as a source of knowledge about *objective conditions* (e.g. statistical data about emissions or psychological profiles about sustainable consumerism) in the development of *subjective definitions* (what newspapers tell their audience to worry about).

3.3 Framing

Function of frames

Social problems theory makes a distinction between what happens in the world (objective conditions) and how people give meaning to what happens in the world (subjective definitions) (Loseke, 2011). The concept of framing was used as a theoretical tool to explore how the issue of livestock farming's climate impact was actively constructed in Dutch newspapers. It enabled the research to search for subjective definitions within real life communication. This theoretical approach will now be explained. "*Framing has to do with making sense, interpreting, and giving meaning to what happens in the ongoing world.*" (Aarts & van Woerkum, 2006, p.229). Frames provide a way of knowing about what happens in the world. The sociologist Erving Goffman is an important founder of the framing theory. In his book 'Frame Analysis' (1974) he explains frames as mental structures that enable people to reach an understanding of reality. The application of framing by different scholars has led to a great variety of approaches to this concept (Dewulf et al., 2009). Therefore the application of this concept in this study will now be made explicit.

Location of frames

A frame can refer to an individual's cognitive understanding of a given situation. This type of frame is often called a frame in thought, an individual frame, or a cognitive frame (Goffman, 1974; Dewulf et al., 2009). Cognitive frames are placed within the minds of people (Dewulf et al., 2009), which could be the mind of the communicator, or a receiver of communication (Entman, 1993). To make sense of the world people place new information into their existing cognitive categories, connecting it to their current expectations of how the world works (Minsky, 1975; Dewulf et al., 2009). A frame can also refer to the words, images, phrases, and presentation styles used to communicate about an issue or event to an audience (Gamson& Modigliani, 1989). This type of frame is often called a frame in communication, a media frame (Gamson& Modigliani, 1989), or an interactional frame (Dewulf et al., 2009). Interactional frames are located in communication (Dewulf et al., 2009) or in text (Entman, 1993). Although it is useful to make a distinction between cognitive and interactional frames, it has to be acknowledged that these types of frames are interactive and influence each other (Aarts & van Woerkum, 2006). This research explored frames in communication and therefore followed Entman's explanation of 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.” (Entman, 1993, p.52). In this definition framing is approached as an action, people ‘do’ framing. It mirrors the constructionist perspective that language is not a neutral tool which people use to describe reality; instead it shapes our view of what is reality (Fischer, 2003). Either consciously or unconsciously, people (including journalists) choose a particular way to describe reality and thereby include and exclude aspects of perceived reality (Dewulf et al., 2009). The chosen way to describe perceived reality inherently promotes a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation (Entman, 1993). In this study frames in newspaper coverage are studied to explore how newspapers made sense of livestock farming as a cause of climate change. By including or excluding information or actors in the news, the media plays an important role in framing the scientific, economic, social and political dimensions of an issue (Anderson, 2009).

What is being framed?

People frame different things: issues, relationships, identities or processes (Dewulf et al., 2009). When people frame issues they communicate about problems, the causes of these problems, and the actors who are considered responsible. When people frame relationships or identities they discursively construct their identity and relation to the problem and each other. When a process is being framed, actors discuss the communication between them in view of the problem (Dewulf et al., 2009). This research is focussed on issue-frames and therefore again mostly follows Entman’s explanation that frames are used to define problems, diagnose causes, make moral judgments and suggest remedies (Entman, 1993). Although Entman does not explicitly say something about responsibility, it is expected that frames also suggest who is responsible for causing or solving the problem. The impact of livestock farming on climate change as such is a phenomenon, not a problem. Its problematic nature is socially constructed. The theory of framing provided guidance to the researcher to study how Dutch newspapers gave meaning to livestock farming as a driver of climate change. It enabled the researcher to analyse how the issue was constructed in mediated reality.

3.4 Key Terms

To avoid confusion the use of the key terms within this study (media & research) will now be clarified. Media refers to *“the main means of mass communication (broadcasting, publishing, and the Internet)”* (Oxford Dictionaries, 2015). This study focussed on Dutch daily newspapers in print, one of the means of mass communication. Research is understood as a socially and culturally constructed notion to describe a particular way of thinking and exploring (Garvin, 2001). This study followed Kumar’s approach that research is *“a process for collecting, analysing and interpreting information to answer questions”* (Kumar, 2005, p.7). Research is often *systematic*: activities to find answers follow a certain logical order; and conclusions are tried to be based on *evidence*, gathered from real-life experiences or observations (Kumar, 2005, p.7). In this report research refers to the results of research, the process of doing research, and the people who perform research (researchers). Research can bring forth assumptions, calculations, measurements, theories, confirmations, questions, critique and advice in the form of written or spoken statements from actors or institutions.

4. Methodology

This chapter provides an overview of the methodology and procedures that were used in this study. It consists of the following sections: approach & design, data & analysis, and verification.

4.1 Approach & Design

Discursive approach & qualitative design

This study aimed to explore real life communication in the form of newspaper content. Therefore it was guided by a textual (discursive) approach. Language was not considered to be a neutral medium representing the real world. Instead, it was considered to be an interactive process which gives meaning to social and physical relations (Hajer, 1993) and therefore shapes our perception of the world (Fischer, 2003 p.41). *“Discourse and discursive practices circumscribe the range of subjects and objects through which people experience the world, specify the views that can be legitimately accepted as knowledge, and constitute actors taken to be the agents of knowledge.”* (Fischer, 2003, p.13). Newspaper articles were analysed to explore the range of objects and subjects through which newspapers represented the issue, how they specified views that were legitimately accepted as knowledge, and which actors were taken to be the agents of knowledge. A qualitative research design was applied to provide an in-depth understanding of how livestock farming as a driver of climate change was constructed in national newspaper coverage.

Focus on livestock farming as a contributor to climate change

The focus on livestock farming's role in climate change was chosen because the livestock sector is an important and contested sector within Dutch society, climate change is an urgent but complex livestock-related problem, and the range of possibilities to interpret and deal with the problem are diverse. Moreover, the focus of this study followed the personal interest of the researcher. The study was bound by its focus on livestock farming and climate change, the Dutch newspaper context, and the time frame 2000-2015. This means that its results cannot be generalized to other situations or populations. However, because this study aimed to understand this topic in itself, this lack of generalizability is in no way unfortunate (Thomas, 2009; Stake, 2005).

4.2 Data & Analysis

Newspaper selection

The data set for the newspaper analysis consisted of 162 articles from the Volkskrant and Telegraaf. These newspapers were chosen because they are the most-read daily newspaper in the Netherlands and complement each other in terms of political focus and level of depth. The Volkskrant has a newspaper circulation of 262.229, and the Telegraaf has a circulation 544.355⁴ (HOI, 2015). The time span 2000-2015 was chosen because of expected public attention to the topic in this period. In the past ten years animal centred groups like the Partij voor de Dieren (Party for the Animals) and Wakker Dier (Animals Awake) became increasingly popular in Dutch society. Furthermore, in this period the Dutch government signed a treaty with the livestock sector about decreasing greenhouse gas emissions and increasing sustainable energy use. And finally, Pot & Termeer (2010) identified

⁴Based on the average circulation in 2013 (HOI, 2015)

increased media coverage regarding environmental issues and sustainability between 2003 and 2009. Newspaper articles were retrieved from online newspaper database LexisNexis using the search term combinations mentioned below. All articles in which livestock's role in climate change was problematized were analysed.

*Veehouderij & klimaatverandering, veehouderij & broeikaseffect, veehouderij & broeikasgassen, veeteelt & klimaatverandering, veeteelt & broeikaseffect, veeteelt & broeikasgassen, vlees & klimaatverandering, vlees & broeikaseffect, vlees & broeikasgassen, melk & klimaatverandering, melk & broeikaseffect, melk & broeikasgassen, veehouderij & opwarming van de aarde, vee & opwarming van de aarde*⁵.

Content analysis

A quantitative content analysis was carried out to find out to what extend newspapers paid attention to the topic in general and topic-related research in particular. The results of this analysis relate to the first sub-question. A qualitative content analysis was carried out on all 162 Telegraaf and Volkskrant articles to explore how research was used by the newspapers to give meaning to the issue. Social problems theory was used to identify how research functioned as a source of knowledge about objective conditions: *real, tangible or measurable existing conditions in the physical world* (Loseke, 2011). The theory of framing was used to explore how research was used in the development of subjective definitions: *explanations of what to worry about* (Loseke, 2011). When applied unsystematically it is possible a researcher finds only frames she expected to find (Tankard, 2001; de Vreese, 2012). Therefore the content analysis within this research mostly followed Tankard's 'list of frames approach' (2001). First a subset of articles was read to identify the range of possible frames and objective conditions. Then a codebook was developed to code the remaining articles accordingly. This codebook contained code descriptions and key-words and can be found in appendix 2. All codes and quotations were categorized and analysed to come to interpretations of the data. The content analysis design was not linear but flexible: an ongoing process of exploration, interpretation, comparison, categorization and evaluation (Thomas, 2009). The computer program Atlas was used to analyse, code and store the data during the research process. The qualitative content analysis provided results to answer the second sub-question and part of the third sub-question.

Scientist interviews

To answer the third sub-question more insight was needed with regard to how the issue has been discussed in the (scientific) research context. Hence, insight into scientific debates was essential to be able to find out to what extend the newspapers mirrored research attention and focus. The researcher did not know enough about the scientific background of livestock farming as a driver of climate change and lacked the resources to review the extensive amount of research reports published on the issue. Moreover, she assumed there was more to know about research results regarding the issue than could be found in scientific journals. Therefore, three Dutch scientists in the field of animal production and environmental sustainability were interviewed to learn more about scientific debates surrounding

⁵ These are the Dutch words for livestock farming, animal farming, climate change, greenhouse gases, greenhouse effect, milk, meat and chicken.

the issue. These scientists are or have been involved in research focussed on different aspects of livestock farming as a driver of climate change. Although they are all connected to Wageningen University, their research highlighted different aspects of the issue and took place within different periods between 2000 and 2015. The interviews were focussed on process knowledge: knowledge that derives from the respondents' involvement in the scientific debate about livestock farming and climate change (van Audenhove, 2007). The interviews were semi-structured, allowing open-ended questions and room for elaboration on initial answers, meanings and perspectives (Gray, 2006). Respondents were searched for via scientific publications and the Wageningen UR website, and approached by telephone. With permission from the respondents the interviews were recorded, transcribed, interpreted and compared to findings from the media analysis.

4.3 Verification

The researcher used her own experience and knowledge about the social world to analyse the data. This was likely to influence how the data was interpreted (Thomas, 2009). Taking this into consideration, the researcher aimed for a thorough, fair and balanced analysis (Thomas, 2009). The following strategies were used to increase the reliability of the research results (Creswell, 2014)

- 1) *Cross-checking codes*: a second researcher was asked to analyse a small sample of articles. The outcomes of the second researcher matched the outcomes of the first researcher and therefore it is assumed that the coding process was fair.
- 2) *Codebook*: a codebook was developed to make sure there was no drift in the definition or application of codes. This codebook can be found in appendix 2.
- 3) *Triangulation*: the results are based on different sources: two newspapers and three scientists.
- 4) *Member checking*: it is important to check whether eventual data is consistent with what the respondents have said (Arksey and Knight, 1999). For this reason the interviewees were asked to check the interpretations of the interviews for their accuracy and comprehensiveness.

Table 1 Research design overview

Research question	Theory, concepts & methodology	Verification	Data sources
1. To what extent was research about the livestock farming as a driver of climate change taken up by the Telegraaf and Volkskrant?	Social problems theory, framing, content analysis	Codebook, cross-checking codes, triangulation	Telegraaf and Volkskrant articles published between 2000 and 2015 including search term combinations
2. How did the Telegraaf and Volkskrant select and represent research to present livestock farming as a driver of climate change?	Social problems theory, science-media interactions, framing, qualitative content analysis	Codebook, cross-checking codes, triangulation	Telegraaf and Volkskrant articles published between 2000 and 2015 including search term combinations
3. To what extent did newspaper coverage mirror scientific debates on livestock farming as a driver of climate change?	Social problems theory, expert-interviews	Member-checking	Dennis Snoek, René Schils, Theun Vellinga

5. Results Research Question 1: Newspaper Attention

This chapter provides the answer to the first sub-question: “To what extent was research about livestock farming as a driver of climate change taken up by the Telegraaf and Volkskrant?” It shows to what extent research was able to contribute to newspaper coverage by focussing on the attention from newspapers to the topic in general and topic-related research in particular. In paragraph 5.4 the results of this chapter are summarised and the sub-question is answered.

5.1 Newspaper Attention to the Topic in General

Between January 1st 2000 and December 31st 2014 the Volkskrant published 113 articles and the Telegraaf published 49 articles in which livestock farming as a driver of climate change was discussed.⁶ Figure 1 shows how newspaper coverage developed over the years.

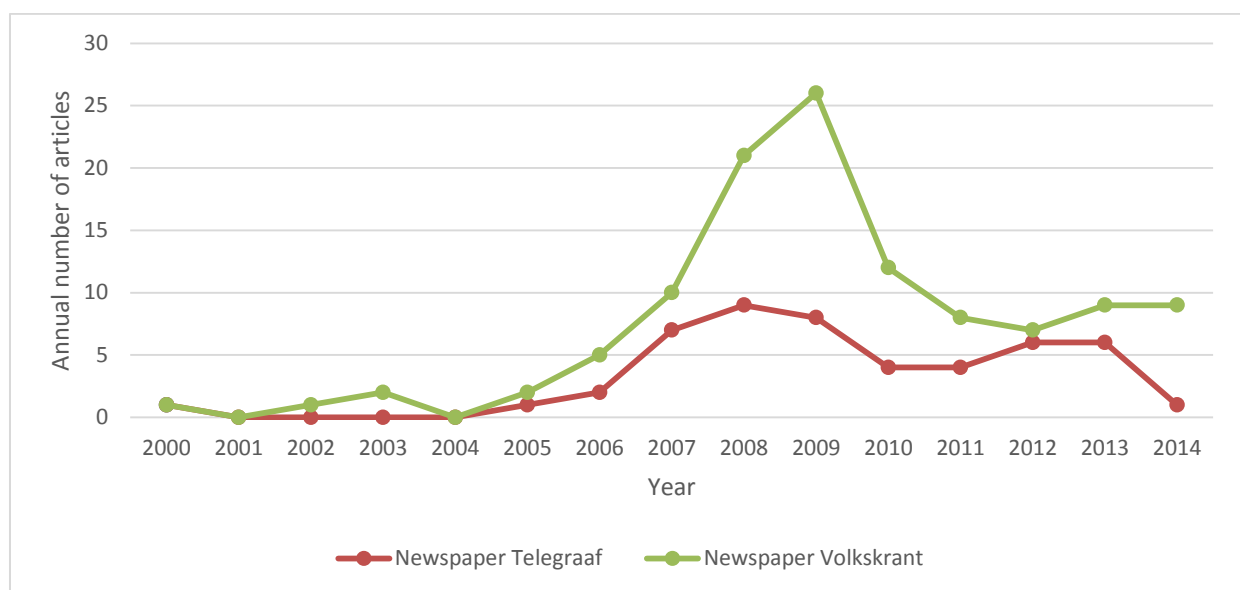


Figure 1 Number of issue-related articles published 2000-2015 by the Telegraaf and Volkskrant

Newspaper coverage in general

Newspaper coverage on the topic was dynamic. Attention increased after 2006, and peaked in 2008 and 2009. It then declined, but until 2013 it remained higher than before 2006. Although most articles with a reference to the problem appeared in the Volkskrant in 2009, most of articles in which livestock's impact on climate change was the main topic appeared in 2007 and 2008. In the Telegraaf most prevalence was given to the topic in 2008. In 69.4% of the Telegraaf articles (34 articles) and 73.5% of the Volkskrant articles (83 articles) the issue was not the main focus of the article. Instead, in these articles the topic was part of more general topics like deforestation or sustainable consumption. For example, the Telegraaf mentioned the topic in articles about the sustainable behaviour of weather woman Helga van Leur (2010) and Prince Friso (2012). The Volkskrant mentioned the topic in an article about the efforts of a journalist trying to live sustainably for one week. The topic was covered as news, in editorial articles, as science, in the culture and restaurant section, in columns, interviews,

⁶ Based on an article search performed by LexisNexis. Articles which did not problematize the topic were excluded (e.g. articles in which impact of climate change on livestock farming was discussed).

letters from readers, discussion sections and in recipe articles. These results support the idea that both the Volkskrant and Telegraaf considered the issue to be newsworthy, important and/or relevant to be communicated to newspaper readers at several points in time. The uptake of the topic in statements made by politicians, celebrities, newspaper readers and spokespersons from nongovernmental organizations (in news and discussion sections of the newspapers) points to an active interest and involvement from societal actors.

Newspaper attention triggers

Several social developments received considerable newspaper attention and are therefore expected to have contributed to newspaper attention in general. First, the documentary 'Meat the Truth', developed by the Nicolaas G. Pierson Foundation commissioned by the Partij voor de Dieren (Party for the Animals) was released in 2007 and received attention in this and following years. Responses to this documentary from politicians and researchers also received media attention. At the start of 2008 Dutch Minister of Agriculture Gerda Verburg presented her ideas for a sustainable livestock sector to the government, which at that time also received attention from both newspapers. The Volkskrant also paid attention to livestock farming's role in climate change in relation to the United Nations Climate Conference that took place in Copenhagen in 2009.

5.2 Newspaper Attention to Research

Research occurrence in articles

Both newspapers referred to research in all years between 2000 and 2015 in a considerable part of the articles. In total the Volkskrant made one or more references to research in 78 of the 113 articles (69%), and the Telegraaf made one or more references to research in 32 of the 49 articles (65%). References to research were made in different newspaper sections (e.g. news, lifestyle, discussion).

Newspaper attention triggers

The following research-related topics received more coverage than others, which suggests they might have contributed to newspaper attention in general. First, the report *Livestock's Long Shadow: Environmental Issues and Options* (Steinfeld et al., 2006). This report about the sustainability of the global livestock sector first received attention from Volkskrant in 2006 and Telegraaf in 2007, but was also referred to in the following years (2007 until 2015). Second, the report *Milieueffecten van Nederlandse consumptie van eiwitrijke producten* (Environmental effects of the Dutch consumption of protein products) (Blonk et al., 2008). This report was commissioned by the Dutch government. Innovations like the development of in-vitro meat and the production of insects for human consumption received newspaper attention. And finally, by participating in and starting public debate researchers drew media attention to the issue. For example, both newspapers reported on responses from research(ers) on the credibility and accuracy of the documentary *Meat the Truth* from the Partij voor de Dieren (Party for the Animals). Furthermore, in 2013 former Chairman of Wageningen UR Aalt Dijkhuizen and Professor Rudy Rabbinge criticised statements from nongovernmental organisation Wakker Dier (Animals Awake) on the climate impact of organic livestock versus conventional livestock.

5.3 Sources, Contributions & References

Research sources

Throughout the years the Volkskrant and Telegraaf paid attention to a wide variety of research documents, institutes and individuals. The following types of research were identified within the newspaper data: 1) scientific, 2) commercial, 3) business-oriented, 4) governmental, 5) non-governmental, and 6) journalistic⁷. The first type of research was presented as purely 'scientific'. These 'scientific' research contributions came from organisations or individuals as part of scientific organisations (e.g. universities or scientific research institutes), for example: a calculation on the sustainability of in-vitro meat performed by Hanna Tuomisto from the University of Oxford. Scientists also appeared as speakers, for example Henning Steinfeld (leading author Livestock's Long Shadow) and Rudy Rabbinge (professor sustainable development at Wageningen UR). A second type of research sources were commercial research organisation or advice agencies. These organisations work independently for commissioners (e.g. corporations, nongovernmental organisations or the government). Examples of commercial research organisations mentioned in the newspaper articles are: Blonk Environmental Advice, CE Delft, CLM Research and Advice, and Ruigrok/Netpanel. The third type of research found in the newspaper articles was performed by corporations or businesses, for example: the ABN Amro bank which studied the sustainability of different products, and animal feed developer Provimi who was part of research on improved animal feed to reduce methane release during enteric fermentation. The Dutch government was not only mentioned as a commissioner of research, research was performed by governmental organisations as well. The newspapers referred to public research organisations like the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency), The Sociaal Cultureel Planbureau (Netherlands Institute for Social Research), Cultureel Planbureau (Netherlands Bureau for Economic Policy Analysis), and Centraal Bureau voor de Statistiek (Statistics Netherlands). The Intergovernmental Panel on Climate Change is commonly known to be an important source of research on climate change. However, the newspapers only referred to this organisation a few times. Far more references were made to the Food and Agriculture Organisation of the United Nations. Non-governmental organisations were also referred to by the newspapers as sources of research. For example, the Volkskrant reported on a calculation done by the Vegetariërsbond (Dutch Union of Vegetarians) about the amount of meat consumed by Dutch citizens during the Christmas Holidays (partly based on the findings from Blonk Environmental Advice). The newspapers did not only report on research, to some extent they performed it as well. The Telegraaf studied public perception by asking its readers to give their opinion regarding with regard to the Stelling van de dag (statement of the day). The Volkskrant compared the sustainability of (animal) products in the Proef (Taste) and Spul (Stuff) columns (e.g. the sustainability of organic chicken vs. conventional chicken).

Research contributions

The newspapers did not discuss entire research projects or reports. Instead, they focussed on one or more of the following aspects: quantitative results (e.g. emission rates), conclusions,

⁷ A complete overview of the sources to which the newspapers referred can be found in appendix 3.

recommendations, and (quantified) expectations of social or environmental developments. The newspapers paid particular attention to research results, and not so much to research design and methodology or uncertainty and generalizability of research results. The newspapers did not only mention research projects and documents, but included statements from researcher-related actors as well. These individuals can be categorised as follows: scientists, people from international or intergovernmental institutions, politically oriented researchers, researchers from commercial research agencies, journalists, researchers from nongovernmental organisations, cooperation's or business. These speakers either took on the role of researcher, talking about research projects, or the role of expert, discussing the issue in a broader sense. Accordingly, some statements focussed on results or ongoing projects, and other statements contained personal or political points of view, or provided consumer advice (e.g. to eat less meat). Neither the speakers nor the newspapers provided clearly indicated where statements about research stopped and personal opinions began. Furthermore, it was often unclear whether the newspapers used direct quotes, or paraphrased statements from (other) documents. The selected and represented parts of research projects and documents, and statements from research-related actors will be referred to in this report as *research contributions*.

In the first few newspaper articles (at the start of the newspaper attention rise) research was used as almost the only source of knowledge. However, in other articles statements from non-research related speakers were also included (e.g. politicians and citizens). This suggests that although the newspapers did pay much attention to research, they also provided space for non-research related speakers to discuss the topic. These speakers often used research contributions to support their statements. To a limited extent some non-research related speakers evaluated research as well. In 2007 the Volkskrant published an article in which Jeremy Riffkin, president of the Foundation on Economic Trends in Washington and author of the book *Beyond Beef: The Rise and Fall of the Cattle Culture*, criticized the report *Livestock's Long Shadow*. Although he supported the statements on the gravity and urgency of the problem, he challenged the lack of emphasis on consumption change as a recommendation for change. This suggests that in both newspapers research became politicized. Hence, when research enters public debates it will be evaluated by society (Weingart, 2002). Moreover, when scientific information becomes relevant for social actors they will use and modify it to communicate arguments and suggestions in line with their interpretation of the issue (Fischer, 2003; Pepermans & Maesele, 2014). Strategic use of research information was found quite often, public evaluation of (scientific) research results was found only a few times (in the Volkskrant).

Direct & indirect use of research

Research contributions were mostly referred to directly by journalists. However, as mentioned in the previous paragraphs, sometimes research was not referred to directly by the newspapers/journalists, but indirectly by other actors who appeared as speakers in the newspaper articles. These speakers referred to research to give an example or to support their statements. For example, research was used by politicians or citizens in their plea for particular solutions (e.g. a meat tax). Table 2 provides an overview of direct and indirect research contributions found in the newspaper data.

Table 2 Direct and indirect research contribution

	Volkskrant	Telegraaf
Articles including research	78 (of 113)	32 (of 49)
Direct references to research	63	23
Direct references to researchers	39	13
Indirect references to research	11	4
Indirect references to researchers	7	1

Reference style

The description of references in appendix 3 mirrors the way they were referred to by the newspapers. As mentioned in the theoretical framework of this report, newspapers are not bound to the standards of referencing found in science. References found in the newspaper content did not resemble the APA style commonly found in science. Newspaper references were inconsistent in terms of which information was included or excluded. Sometimes names of reports were included, and sometimes only the names of the authors or institution by which it was published. The typology of research sources given above follows this inconsistency found in newspaper references. Therefore, sources that were labelled as ‘governmental’ could include scientific measurements or calculations. The function of these labels is to provide insight into the wide variety of research sources, rather than to provide exclusive categories. On occasion the names of speakers were accompanied by their function or education status (e.g. professor, doctor etc.) but this was also inconsistently done. What is more, sometimes information from research was used without any reference to a source whatsoever. In these cases research contributions (e.g. measurements or calculations) were presented as facts, or common knowledge, rather than the result of a study. In line with these unclear references to research it was impossible to trace all statements which were based on research. Therefore it is assumed research had an even bigger role in newspaper coverage than the numbers in this chapter suggest.

5.4 Recap & Conclusion

Both the Telegraaf and Volkskrant paid attention to research, throughout the entire time span and to a considerable extent. It suggests that knowledge from research was considered newsworthy, relevant or important to be communicated to newspaper readers. Moreover, it confirms that research did contribute to newspaper coverage. It corresponds to the theoretical assumption that in face of complex problems like climate change research has become an important source of knowledge for the media (Scheufele, 2014). Most attention was paid to research results, conclusions, and recommendations. Less attention was paid to methodologies and uncertainty of research findings. Different types of research received attention: national and international, scientific and non-scientific. These results challenge the idea that ‘science’ is the only suitable source of knowledge about environmental problems like climate change. Written documents and statements from researchers were mentioned, both directly by the newspapers and indirectly by other societal actors. These results point towards an active interest in research from newspapers and other societal actors, and the politization of science within the newspaper content (Weingart, 2002).

6. Results Research Question 2: Newspaper Content

This chapter presents the results regarding the second sub-question: “How did the Telegraaf and Volkskrant select and represent research to present livestock farming as a driver of climate change?” In paragraph 6.1 the identification of frames and research contributions within the newspaper content is explained. Paragraphs 6.2-6.4 provide an overview of how research contributed to the different issue-frames that were identified. Paragraph 6.5 answers the sub-question. Quotes from the newspaper content are included in blue.

6.1 Frame & Research Identification

How newspapers framed livestock’s role in climate change

This chapter describes the role of research in how the newspapers gave meaning to livestock’s role in climate change. The first step in the newspaper analysis was to explore how newspapers gave meaning to livestock’s role in climate change. The concept of framing was applied to identify *subjective definitions*: how the newspapers told their audience what to worry about (Loseke, 2011). In line with Entman’s theory of framing (1993), all 162 newspaper articles were analysed by identifying, coding and categorizing problem definitions, causal interpretations, moral evaluations, and treatment recommendations within the text. This resulted in the identification of three issue-frames: 1) consumption & lifestyle, 2) production & supply, 3) governance. When the newspapers applied the consumption & lifestyle frame they focussed on consumption and waste of animal products. When newspapers applied the production & supply frame they focussed on emissions and mitigation opportunities in production and supply of (animal) products. When newspapers applied the governance frame they focussed on governmental tools and structures that positively or negatively influence emissions and mitigation options related to livestock farming and animal consumption. These frames were found within both newspapers and appeared throughout the entire time span 2000-2015. Moreover, it was found that these frames were not mutually exclusive. Instead, in several articles multiple issue-frames were identified. Table 3 provides an overview of the prominence of these frames. The frames were not predefined by the researcher, but emerged from the data. It cannot be said that these are the only right interpretations, because they are based on the researcher’s interpretations. However, through the use of a codebook, triangulation and cross checking the researcher sought to provide most plausible interpretations.

Table 3 Issue-frame occurrence in the Volkskrant and Telegraaf 2000-2015

Issue-frames	Volkskrant	Telegraaf
1) Consumption & Lifestyle	54 (47%) ⁸	31 (53%)
2) Production & Supply	38 (34%)	18 (31%)
3) Governance	31 (27%)	9 (16%)

⁸ Number and percentage of articles in which the frame was found. Total is not 100% because sometimes several frames were found within the same article.

How newspapers used research to frame livestock's role in climate change

This chapter describes the role of research in how the newspapers made sense of livestock's role in climate change. The second step in the newspaper analysis was to explore how the newspapers used research within the frames mentioned above. This was done by identifying and analysing research contributions⁹ within the newspaper articles (e.g. results, conclusions, statements, recommendations). These research contributions were coded and categorized according to the frames they applied to and the objective condition they provided knowledge on. *Objective conditions* refer to real, tangible or measurable existing conditions in the physical world (Loseke, 2011). The research analysis was not predefined but emerged from the data and followed the codebook which is included in appendix 2. The following paragraphs discuss the frames and the role of research within these frames.

6.2 Issue-frame 1: Consumption & Lifestyle

Frame description

In 54 (47%) of the Volkskrant articles and 27 (55%) of the Telegraaf articles livestock's role in climate change was defined as a problem of individual consumption and lifestyle. Within this frame the causal interpretation focussed on unsustainable behaviour of citizens/consumers. Livestock-related greenhouse gas emissions were attributed to consumption of (unsustainable) animal products, food spillage, and waste production. This frame contained a moral obligation towards citizens/consumers to employ a more sustainable lifestyle. Accordingly, the following treatment recommendations (solutions) were proposed: reduced consumption of animal products, reduced waste of animal products, and consumption of less polluting types of products (e.g. poultry instead of beef). Different levels of consumption change were proposed, ranging from one vegetarian dish a week to vegan living.

"I go everywhere by bike and eat meat only twice a week, because our meat consumption has an enormous impact on the environment. It really isn't difficult to do something as an individual to improve the world. Just start with yourself." (Student appeared as a speaker in Telegraaf, November 26, 2011)

Occasionally this frame contained statements about sustainable restaurants or fast-food shops. Sometimes the need for individual action was substantiated by statements about the inability of governments to make decisions or to take action.

"Global agreements like that of Copenhagen are essential. But politicians are scared creatures, who don't dare to force you to live differently. Eventually you will really have to save this planet by yourself." (Volkskrant, December 18, 2009)

Research in the consumption & lifestyle frame

The Telegraaf and Volkskrant selected and represented a wide variety of research contributions within the consumption-frame. The results of the research analysis are summarised in table 4. In the first column the objective conditions on which research provided knowledge are mentioned. The reference numbers in the middle columns correspond to those in the reference list which can be found in

⁹ A typology of research contributions was provided in chapter 5

appendix 3. The column on the right shows the function of research contributions within the text. The content of this table is discussed further in the following paragraphs.

Table 4 Research contributions consumption frame

Objective condition	Volkskrant sources	Telegraaf sources	Function
1. Current emissions from the livestock sector on a global and national level	3, 4, 12, 13, 36, 39	2, 5, 19, 23	General problematization Call for action Evaluating national situation
2. Emission sources and rates within the livestock sector	3, 4, 6, 13, 82	5, 13, 17, 33	Explanation of why livestock results in emissions
3. Expected increase in global demand for animal products	12, 13, 82	19, 23	Emphasizing potential aggravation of the issue
4. Current consumption and emissions	3, 4, 5, 11, 25, 41, 51, 58, 70, 84	6, 11, 12	Problematization and moral evaluation of consumer behaviour
5. Sustainability of different diets & potential emission reductions	3, 4, 9, 13, 20, 33, 37, 42, 47, 51, 52, 66, 71, 74, 76, 78, 82, 84	2, 7, 8, 19, 23, 27, 33	Promoting and evaluating dietary changes
6. Sustainability of different products	1, 3, 4, 23, 23, 25, 27, 38, 40, 44, 47, 48, 49, 51, 60, 62, 67, 72, 84	2, 8, 17, 19, 33	Providing consumer advice

1. Current emissions from the livestock sector on a global and national level

As shown in table 4, both newspapers presented research about current emissions from the global and national livestock sector. Quantitative research results were used to define the relative share of greenhouse gas emissions from the livestock sector as part of all greenhouse gas emissions worldwide. This was almost always done in terms of a percentage, often accompanied by a comparison between livestock emissions and emissions from transport/traffic.

“At the end of last year a report from the FAO, the food- and agriculture organisation of the United Nations, appeared. This report says that 18% of the global greenhouse effect is caused by livestock farming. This is more than the entire transport sector.” (Telegraaf, November 3, 2007)

These research results were mentioned both directly by journalists and indirectly by other speakers (politicians, researchers, spokespersons from nongovernmental organisations, and citizens). Journalists and speakers often did not make a clear reference to research as a source of this information. Moreover, initial research results were sometimes rephrased, resulting in a somewhat different meaning. For example, emissions were attributed only to cows instead of the entire sector.

“With irrefutable numbers it is shown that cows contribute more to the greenhouse effect than cars. I think it is inevitable that these alarming messages should lead to action, aiming to banish all meat consumption.” (Letter from reader in Volkskrant, January 6, 2007)

Statements about global emissions were almost exclusively based on the Food and Agriculture Organisation of the United Nations, and in particular the report Livestock's Long Shadow. This information was hardly ever questioned. The Volkskrant referred to one study from Finnish scientists who measured lower emissions from livestock farming. However, the newspaper itself questioned the credibility of this study and its generalizability to the Dutch situation. The Volkskrant also included

statements from the president of the meat sector, who tried to downplay the problematic nature of livestock emissions. Nevertheless, both newspapers retained a general consensus of the actual existence and problematic nature of greenhouse gas emissions from the livestock sector.

Within this frame the newspapers also selected and represented research contributions regarding the Dutch livestock sector. The relative share of livestock emissions in national greenhouse gas emissions was presented, sometimes in comparison to emissions from the transport sector. National emissions were compared to international/global emissions by presenting a research result regarding the climate impact of a Dutch product compared to a Brazilian product.

*“The production of a Dutch Chicken leg causes much less greenhouse gases than a Brazilian steak.”
(Volkskrant, January 30, 2008)*

Important sources regarding these national emissions were results from a research performed by Blonk Environmental Advice (both newspapers), statements from researcher Hans Blonk, and a research report from Wageningen UR researchers (Telegraaf). Both studies were presented in reaction to the documentary ‘Meat the Truth’ from the Partij voor de Dieren (Party for the Animals) in which the Dutch livestock sector is portrayed as a very unsustainable sector.

*“Although the researchers largely agree with the film makers, they state that some nuances are needed. Compared to other countries, in our country there is a relatively climate friendly way of meat production. Only nine percent of greenhouse gas emissions can be attributed directly to livestock farming here.”
(Climate and Livestock report response to the Meat the Truth documentary, Telegraaf, April 22, 2008)*

Research contributions regarding global livestock emissions were used in both newspapers and by both journalists and other speakers to problematize the livestock sector as a source of greenhouse gas emissions and a driver of climate change. Moreover, global emission rates and comparisons to transport emissions were used to emphasize the gravity of the issue. To some extent the newspapers also presented national emission. However, global emission rates (which are higher than national rates) were used more often to indicate the existence of a problem. Research results about national emissions were used to nuance the problem and to underline the relatively low emission rates from the Dutch sector. Nevertheless, livestock emission rates were clearly problematized by both newspapers.

Objective condition 2: Emission sources & rates within the livestock sector

Both newspapers included statements from (livestock) researchers and research reports (e.g. Livestock’s Long Shadow) to identify sources of emissions within the livestock sector, like enteric fermentation of ruminants, manure management and deforestation. Sometimes the type of greenhouse gas emitted during these activities was defined (methane, nitrous oxide, carbon dioxide).

“A cow farts or burbs every forty seconds. [...] In this process methane is released from the rumen (one of the four stomachs of a cow) and this gas warms the earth 21 times faster than carbon dioxide (CO₂) which is released from fuel.” (Telegraaf, November 3, 2007)

The purpose of these research contributions (which were presented as explanations rather than research results) was to explain why livestock farming contributes to climate change and to emphasize/problematicize the climate impact of non- CO₂ gases which are emitted by the sector.

Objective condition 3: Expected increase in global demand for animal products

Both newspapers presented prognostic research calculations about an expected increase in the demand for animal products. Usually this was done by providing an estimated increase by 2050. Additionally, the newspapers presented reasons for this increase given by the research sources: global population growth and income rise in developing countries.

“According to the FAO the demand for meat in the world will double between 2002 and 2050. It is a recipe for disaster, because the meat sector is already one of the most polluting and energy consuming sectors in the world.” (Volkskrant, December 17, 2011)

These prognostic calculations were used both directly by journalists and indirectly by other speakers to emphasize the potential aggravation of the problem. Again, the most important source was the Food and Agriculture Organisation of the United Nations. And again, often no clear reference to a source was included. Nevertheless, initial research information was not rephrased into different statements.

Objective condition 4: Current consumption and emissions

In both newspapers the current consumption of animal food products was quantified and evaluated. The Volkskrant and Telegraaf presented quantitative results from research calculations about the amount of animal products currently consumed, and the emissions currently caused by consumption. This was done per household, meal, product, dog/cat, and men vs. women (men eat more meat).

“The consumption of animal products in the Netherlands leads to the emission of 10 megatons of carbon dioxide (CO₂) annually. This is at least 6 percent of the total emissions from the Netherlands. This was reported by the agency Blonk Environmental Advice assigned by the ministries of VROM and Agriculture, Nature and Food Quality.” (Volkskrant, January 30, 2008)

Both newspapers presented research conclusions that currently consumers do not voluntarily choose products with low emissions rates over products with higher emissions rates. For example, the Telegraaf published results from a public opinion poll performed by the newspaper itself.

“Almost no one pays attention to food miles that products from the supermarket have travelled and almost no one chooses not to eat meat out of climate considerations.” (Result from reactions on Stelling van de Dag (statement of the day) in the Telegraaf, December 8, 2009)

These research results about consumption and emissions were used to problematize current consumption and to provide a moral evaluation of consumer behaviour. Hence, current consumption was quantified as unsustainable, and current emissions as too high. The newspapers also used research to involve newspaper readers in the problem; newspaper readers are also consumers.

Objective condition 5: Sustainability of different diets & potential emission reductions

The newspapers used research to quantify current consumption. However, more often they presented research contributions to evaluate the sustainability of different diets. Most commonly, meat consumption was compared to vegetarian consumption. Quantitative research results about how much plant-based protein is needed to produce meat (input-output ratio) were mentioned. Additionally, information was provided about how much of the global arable harvest is fed to animals instead of humans. References were made to research documents and statements made by researchers.

“90 percent of our beef is produced in Europe and is mostly fed with grass, maize, wheat and other grains, says Henk Westbroek from the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency). In this process a lot of energy goes up in smoke: for a kilogram of beef 8 to 10 kilogrammes of plant-based feed are needed.” (Volkskrant, October 24, 2009)

The newspapers used these results to problematize animal consumption and to support reduced meat consumption. The results were mentioned both directly by journalists and indirectly by citizens, food advice individuals, and politicians. However, the newspapers also presented research statements in which the benefits of a vegetarian diet were challenged. For example, in the Telegraaf a researcher explained that to some extent cows are sustainable because they can convert indigestible products (grass) into products for human consumption. Furthermore, the Volkskrant presented statements from Animal Scientist Imke de Boer about how much can be produced to feed the Dutch population sustainably. Statements from Hans Blonk and Henning Steinfeld about limitations of replacing meat by fish or soybean were also included. For example, replacing meat by fish was considered problematic with regard to fish depletion, soy was considered problematic with regard to large-scale deforestation.

“Is a vegetarian therefore always more climate friendly than a meat eater? That’s a difficult matter, says Harry Aiking from the VU Amsterdam, author of the in 2006 published book Sustainable protein production and consumption: Pigs or peas? [...]. A cow isn’t such an efficient protein-converter, says Aiking. But, says Aiking, when these dairy products come from cows that have been in paddocks it is okay. Because grass cannot be eaten by people it is not so bad when these inefficient protein converters (cows) are on there. In fact, then cow meat is not that bad.” (Volkskrant, July 5, 2008)

The purpose of these research contributions was to answer the question whether vegetarianism is better and to challenge the idea of vegetarianism as a panacea (a solution to the entire problem). Nevertheless, it has to be acknowledged that reduced meat consumption remained the most supported mitigation option in both newspapers. On multiple occasions the newspapers used research as an introduction to more personalised news articles (e.g. to introduce a vegetarian recipe, a restaurant review, or an interview with a celebrity about his/her (sustainable) consumption). Research was used directly and indirectly to present and explain the issue, and ‘normal’ citizens (e.g. celebrities and newspaper readers) were presented as knowledgeable actors regarding real life sustainable consumption. Sometimes limitations of vegetarian consumption were disregarded by speakers who were included in the newspapers. For example, the Telegraaf presented a statement from the bishop

of Groningen-Leeuwarden who proposed fish consumption as a solution, disregarding problems with fish depletion.

“The old-fashioned habit of not eating beef- or pork but fish on Friday should be revived as a weapon against global warming. This was advocated yesterday by Gerard de Korte, bishop of Groningen-Leeuwarden.” (Telegraaf, December 15, 2009)

Both newspapers presented statements about health and meat consumption in combination with greenhouse gas emissions. In one Volkskrant article this was based on research results: a research on sustainability and health of consumption performed by David Tilman and Michael Clark, ecologists from the University of Minnesota. Conclusions from this report were that vegetarianism, a Mediterranean diet or diet with a lot of fish is better for both peoples' health and the environment. Several other researchers were presented as advocates for a diet with less meat (in different degrees): Harry Aiking, Rajendra Pachauri, Michael Pollan, Rudy Rabbinge, Henk Westbroek (Volkskrant), Klaas Jan Kramer (Telegraaf). The Telegraaf presented the conclusion from a study performed by SenterNovem that according to climate professionals consumers should become more involved.

“Consuming less meat and dairy, that is what we should do, says Westbroek from PBL.” (Volkskrant, October 24, 2009)

Both newspapers presented research calculations focussed on the potential reduction of greenhouse gas emissions following consumption change (especially reduced meat consumption). Sometimes mitigating potential of reduced meat consumption was compared to other mitigation options, like reduced traffic.

“The Institute for Environmental Questions has figured out that when the Dutch Population does not eat meat 1 day a week this will save as much CO₂ as when 1 million cars are taken off the road. This saves twice as many greenhouse gases as when all light bulbs are replaced by energy saving lights and we meet all governmental goals for households in 2010.” (Telegraaf, November 26, 2009)

The newspapers used these quantitative results to emphasize the effectiveness of consumption change. They were used both directly by the newspapers and indirectly by citizens and politicians. However, the newspapers also included statements in which this potential emission reduction was challenged. The newspapers used these statements to balance and nuance the potential impact of consumption change. For example, the calculation from Instituut voor Milieuvraagstukken (Institute for Environmental Questions) mentioned above was criticized by researcher Hans Blonk. He pointed out that the institute applied global data to the Dutch situation, overestimating potential emission reductions following consumption change.

“Environmental advisor Hans Blonk, who provided the numbers to the PBL, explains that this difference [smaller emission reduction following consumption change] exists because he specifically looked at the

Dutch situation. If you collect worldwide statistics, like the VU-researchers did, this results in different numbers.” (Volkskrant, October 24, 2009)

Objective condition 6: Sustainability of different products

Closely linked to research contributions discussed in the previous paragraph, are research contributions that focussed on the sustainability of (animal) food products. Both newspapers paid considerable attention to the climate impact of different products. These products were compared according to their climate impact based on emissions during the production process. Sometimes animal welfare aspects were also included.

“Organic ground beef is most animal- and environmentally friendly. At least, according to the VleesWijzer which Stichting Varkens in Nood (Pigs in Distress) and Vereniging Milieudefensie (Environmental Defence) present today.” (Volkskrant, October 27, 2009)

These arrangements were made by researchers and consumer advice organisations which claimed to rely on research results. Statements from researchers and conclusions from reports were used. For example, the newspapers referred to the Vleeswijzer (Meat Indicator) which was developed by Varkens in Nood (Pigs in Distress) and Milieudefensie (Environmental Defence). This Vleeswijzer was based on research from Blonk Environmental Advice ethologist Francien de Jonge. Research findings regarding the climate impact of products was used to provide the newspaper audience with advice on how to consume sustainably. Research was used to support the credibility of these arrangements. Generally, vegetarian products were proposed as most sustainable. However, the newspapers also included statements from researchers who emphasized the complexity and simplification of these arrangements. In this sense newspaper articles sometimes contained contradictory information.

“When soy beans, the basic ingredient of many vegetarian products, are made into simple tofu, this demands little energy. But when it is transformed into a tasteful fake stake this is different, says Reijnders. You have to do all kinds of things with the protein, like spinning. This demands almost as much energy as a real stake.” (Volkskrant, July 5, 2008)

6.3 Issue-frame 2: Production & Supply

Frame description

In 38 (34%) of the Volkskrant articles and 17 (35%) of the Telegraaf articles livestock's role in climate change was defined as a problem of production. The causal interpretation within this frame focussed on problems within the production chain from animal feed production up to consumption (consumption not included). Livestock related greenhouse gas emissions were attributed to technological and managerial problems within current systems, and the physical aspects of animals. Accordingly, this frame contained a moral obligation towards the livestock sector to produce more sustainably, and companies/research institutes to develop more sustainable systems or products. This frame contained 3 types of mitigation strategies. The first type of mitigation strategies focussed on efficiency and technological & managerial innovations (e.g. improved animal feed, on-farm energy production, and animal feed additives to reduce methane production from ruminants).

“Harm caused by intensive livestock farming to the environment can be limited by developing a special vaccine, says animal health product developer Intervet.” (Volkskrant, August 23, 2010).

The second type of mitigation strategies focussed on the ‘de-industrialisation’ of the livestock sector. Instead of aiming for technological improvements, these mitigation options were focussed on restructuring the livestock sector to a more small-scaled and/or organic sector. These mitigation options did not receive much support in the Telegraaf. In the Volkskrant these mitigation options mostly received indirect support from societal actors who appeared as speakers within the coverage.

“We should strive for sustainable agriculture with more biodiversity and farmers. Because, if there is one thing which has caused us trouble, it is the efficiency of industrial agriculture, where farmers run their company from a computer. Sustainable agriculture demands more labour. That is why we need more farmers” (Michael Pollan in Volkskrant, February 12, 2009)

The third type of mitigation within this frame was the development of products to replace current animal products. For example: in-vitro meat, insects, kangaroo meat, and vegetarian burgers. The production process of these product-replacements was considered more climate-friendly.

“The meat industry is responsible for 18% of global greenhouse gas emissions, more than all planes, cars and ships combined. And then we aren’t even talking about animal suffering in the intensive livestock sector. With in-vitro meat these problems disappear all at once.” (Volkskrant, August 3, 2013)

Research in the production & supply frame

Both the Telegraaf and Volkskrant used research within the production & supply frame. Which research contributions were selected and how they were represented within the newspaper content will now be described. The following paragraphs are arranged according to the objective conditions on which research contributions provided knowledge. In table 5 the results are summarised. The numbers in the middle columns correspond to those in the reference list which can be found in appendix 3.

Table 5 Research contributions in the production & supply frame

Objective conditions	Volkskrant sources	Telegraaf sources	Function
1. Current emissions from the livestock sector on a global and national level	3, 4, 12, 13, 26	2, 3, 5, 9, 14, 23, 26	General problematization Call for action Evaluating national situation
2. Expected increase in global demand for animal products	12, 58, 63	23	Emphasizing urgency of problem & inability of current system to suffice the needs of contemporary societies
3. Emissions & mitigation options on farm-level	2, 15, 16, 20, 45, 46, 58, 65, 77, 81, 87, 88	13, 16, 18, 20, 25	Explain/evaluate mitigation options Emphasizing sustainability Dutch system
4. Sustainability & feasibility on system level	3, 4, 12, 13, 21, 27, 33, 35, 40, 47, 51, 57, 58, 62, 67, 71, 73	2, 4, 19, 24, 30	Evaluate sustainability current livestock systems Evaluate feasibility organic livestock systems
5. Sustainability & feasibility of product replacements	3, 4, 7, 8, 10, 14, 17, 34, 53, 55, 58, 61, 69, 76, 86	15, 22, 23, 26, 27, 28, 29, 31	Emphasizing sustainability of replacement products compared to current products Evaluating feasibility of replacement products

Objective condition 1: Global and national emissions from the livestock sector in general

Just like in the consumption & lifestyle frame, within this frame the newspapers included quantitative research results about the relative share of global livestock emissions in the total amount of greenhouse gas emissions. Most often a reference was made to the Food and Agriculture Organisation and/or the report Livestock's Long Shadow. The purpose of these research results was to problematize the livestock sector as a source of greenhouse gas emissions and to emphasize the gravity of this problem. Quantitative research results regarding emissions from the sector were often uttered in combination with conclusions from reports and statements from researchers (and other actors) about the sustainability of the Dutch livestock sector (objective condition 4) and Dutch products (objective condition 5). Hence, Dutch emissions per product are lower because of the way the Dutch livestock system works. Dutch emission rates were used to emphasize the sustainability of Dutch systems and to challenge statements from actors who were reported to say otherwise (e.g. the Partij voor de Dieren). Especially the Telegraaf used research to challenge these statements.

"The study from Blonk Environmental Advice "finally puts the climate question and Dutch agriculture in the right perspective", says Verburg. In contrast to all those nasty allegations made by the Partij voor de Dieren (Party for the Animals), it seems that Dutch farmers are in fact climate champions. The production of a kilogram of Brazilian beef costs 59 kilogrammes of CO₂; Dutch pork 4.5 kg CO₂. Our chicken is even better than Tofu because this meat replacement needs more fossil fuel. Oh, and if you are really afraid of climate change, you can better ignore organic meat." (Telegraaf, November 9, 2008)

Objective condition 2: Expected increase in global demand for animal products

Both newspapers presented results of prognostic research calculations about the expected increase of demand for animal products caused by global population growth and income rise in developing countries. Usually this was done by providing an estimated increase by 2050. The purpose of these research prognostics was to emphasize the need to change current livestock systems in order to meet this demand. In some articles social speakers used this expected increase to emphasize the inability of current systems to meet this demand.

"Last year worldwide 297 million tonnes of meat were consumed, this will increase up till 470 million tonnes by 2050. [...]. To prevent a food crisis we should eat less meat. Furthermore, in-vitro meat offers a solution, says Brin. [...]. Overall livestock is responsible for 40% of all methane emissions. It is believed that when this is limited, it is considerably better for the environment." (Telegraaf, August 6, 2013)

Objective condition 3: Emissions and mitigation options on farm-level

Over the years the Telegraaf and Volkskrant paid attention to a number of ongoing (not yet completed) research projects regarding farm level mitigation. These projects focussed on the following innovations: methane reducing pills, vaccines, feed additives, energy production from solar panels or manure, improved production and efficiency (input-output ratio), transporting bacteria from kangaroos into cow stomachs, breeding goats without methane-producing bacteria, fertilization management, and manure storage. Not all of these mitigation options were explained and sometimes only 'improved efficiency' or 'new production systems' was mentioned. However, when these mitigation options were discussed in

more depth, statements from scientific and commercial researchers in the fields of animal physiology, animal feed production, energy production, methane concentrations, and soil management were included. These researchers explained why and how certain parts of the livestock chain result in greenhouse gas emissions, and how their innovation project sought or succeeded to reduce these emissions. Additionally, sometimes researchers explained the challenges they faced in the development of these innovations. For example, in the Telegraaf researcher Frits van der Schans explained how animal feed improvement can reduce emissions caused by enteric fermentation from ruminants. The Volkskrant included statements from Sander van Zijderveld about animal feed improvement, and research director Rene Aerts about the development of a vaccine against methane production. Research was the most important source of knowledge regarding the development of on-farm mitigation options. Few farmers were reported as speakers or sources of information. Research was also used by the newspapers (especially the Telegraaf) to emphasize the sustainability of the Dutch livestock sector as a result of its efficiency and technological innovativeness.

“Sander van Zijderveld, who is working at a thesis about the research at the animal feed company, explains what it is exactly what they do in the stables. With tubes attached above the nostrils of every cow the amount of methane which is released is measured 24 hours a day. And because ingredients of some plants are known to have an oppressive effect on methane production, the diet of cows is adjusted regularly.” (Volkskrant, September 6, 2008)

Objective condition 4: Sustainability & feasibility on system level

The newspapers used research to evaluate and compare the sustainability of different livestock systems. As mentioned before, to some extent this was done on an international level. Both newspapers presented results from the research performed by Blonk Environmental Advice commissioned by the Dutch government about the sustainability of the Dutch livestock sector. Dutch animal products were compared to Brazilian products in terms of emissions. Furthermore, some (but few) research-related speakers which appeared in the newspapers emphasized the mitigation potential in non-European countries because of their low efficiency compared to the Dutch situation (e.g. food expert Louise Fresco and animal feed expert Jan Dijkstra). The newspapers did not refer to mitigation options in other countries directly.

“Dijkstra points out that the problems with methane mostly play in poor countries where cows produce little milk and have to eat much (bad) feed so emit more gases.” (Telegraaf, November 3, 2007)

Quite often the newspapers used research to compare livestock systems on a more national level. Generally, organic livestock production was compared to conventional/intensive livestock production in terms of energy use, emissions, demand for animal feed, and input-output ratio. These comparisons were mostly based on research conclusions in which either organic or conventional production was presented as the ‘winner’. The Volkskrant was found to perform a kind of research itself as well. In the ‘Proef’ (Taste) and ‘Spul’ (Stuff) columns organic products were compared to conventional products in terms of animal welfare and environmental impact. Sometimes organic products were considered more sustainable and sometimes conventional products. Moreover, sometimes conventional products

'won' in terms of environmental impact (e.g. based on emissions) but were still framed as negative because of animal welfare aspects or manure production. However, apart from some statements from researchers about the importance of animal welfare, research was not used to provide insight into current animal welfare standards within this frame.

"Because of the large scale way of breeding the environmental impact of conventional chicks is less than that of organic chicks. Conventional breeding uses less gas and electricity, less feed, straw and space and they emit a bit less greenhouse gases. Moreover, organic chickens live longer and therefore they have to eat more and produce more manure." (Volkskrant, April 19, 2008)

Discussion about the sustainability of livestock systems was present in both newspapers and included the representation of a wide range of research projects, documents and speakers. The newspapers directly referred to research conclusions to evaluate Dutch livestock systems, often in response to the documentary 'Meat the Truth' from the Partij voor de Dieren (Party for the Animals). Furthermore, research-related actors appeared as speakers to present their point of view regarding this matter. Michael Pollan was introduced as author of the Omnivore's Dilemma and Defence of Food and Knight Professor of Science and environmental journalism at the University of California. He did not refer to research but was presented as a research-related person (scientist) by the Volkskrant. He criticized the industrialization of contemporary livestock farming and agriculture. Politician Marianne Thieme mentioned that LEI research institute calculated that an organic livestock sector would be feasible if everyone participates, and additional costs would be limited. She also mentioned how many animals live in the 'bio-industry' and how much manure they produce, but did not refer to a research source.

"We need to go to a much smaller livestock sector. In our country, more than 500 million animals suffer and die in the bio-industry; this does not bring us prosperity, but calamity in the form of a declining and disappearing nature, animal diseases, unsafe food, health problems and a crumbling civilization." (Marianne Thieme in Volkskrant, March 1, 2013)

Speakers like Louise Fresco, Aalt Dijkhuizen and Rudy Rabbinge supported innovation and challenged the possibility of organic agriculture to feed the world. Nevertheless, Louise Fresco did make a statement in the Volkskrant that intensification in the Dutch livestock sector has almost reached its limits. Other sources supporting innovation over de-industrialisation were the report Klimaat en Veehouderij (Livestock and Climate) from Wageningen UR researchers, and Hans Blonk. Both newspapers used these research contributions to balance or nuance statements made by stakeholders like the Partij voor de Dieren (Party for the Animals) and Wakker Dier (Animals Awake).

"Action groups like Wakker Dier (Animals Awake) try to force supermarkets to choose for less chicken meat from the conventional livestock sector. [...]. I think this is a peculiar development, says Dijkhuizen. Because the Dutch livestock sector is the cleanest in the world. Often organic is seen as most sustainable, explains Dijkhuizen. With regard to the use of raw materials and greenhouse gas emissions per kilogramme of product this is demonstrably incorrect." (Volkskrant, January 12, 2013)

The newspapers also provided space to non-research related actors (politicians, citizens, celebrities) to discuss livestock systems. These speakers made strategic use of research conclusions and referred to research institutes/individuals to support their statements. For example, the Food and Agriculture Organisation was indirectly referred to as a supporter of intensive livestock farming by the Dutch minister Verburg to support her claim that the Dutch livestock sector is sustainable. However, this organization was also used by politician Marianne Thieme to criticize intensive livestock farming and to support her claim that the Dutch livestock sector is unsustainable. Thieme referred to Louise Fresco who made a statement about how much land is occupied by the livestock sector. However, she also criticized Louise Fresco and Aalt Dijkhuizen from the Wageningen University for supporting the development of mega-stables. The Volkskrant asked Michael Pollan to respond on scientists who think organic agriculture cannot feed the world. Pollan stated that experts contradict each other and that some research results support the feasibility of organic agriculture. Furthermore, the Volkskrant published an article in which Marc Davidson, environmental ethicist at the University of Amsterdam, challenged statements made by Louise Fresco in an interview that was published earlier. Hence, the Volkskrant was found to provide a stage for actors challenging science, albeit to a limited extent.

“There’s nothing wrong with having an opinion in the debate. For a fruitful discussion it is however practical when one indicates where science stops and his/her own moral values and risk perception begin. This is done too little by Fresco in her book. It is objectionable when those who have opposite values and risk perceptions as ‘shadow thinkers’, which have a ‘magical’ world view against her ‘scientific’ look.” (Volkskrant, October, 18, 2012)

Objective condition 5: Sustainability & feasibility of product replacements

One of the mitigation options presented by the newspapers within this frame was the replacement of current animal products by other products (e.g. in-vitro meat, insects, and kangaroo meat). Both newspapers paid attention to (ongoing) projects on the development of these replacement products. In one Volkskrant article the financier of a project appeared as a speaker, but mostly it were researchers, specialized in one particular innovation. For example, entomologists Arnold van Huis and Marcel Dicke (connected to Wageningen University and authors of an insect cookbook) discussed the production, and consumption of insects, and in-vitro researcher Mark Post talked about the development of in-vitro meat. These speakers discussed the project/product, the production process, the benefits of these products and the challenges in their development. The newspapers also presented several documents written by scientists on these products. These statements and research results were used by both newspapers to compare current animal products to replacement products in terms of emission rates, the use of land, raw materials and energy use, and animal welfare. Emissions were quantified as CO₂ equivalent or as a percentage. For example, the Volkskrant included research in which the climate impact of in-vitro meat production was compared to current meat production.

“Provisional calculations show that with the production of meat from stem cells 35-60% less energy is needed, 80-95% less greenhouse gases is emitted, and the land use is negligible. Stem cells do not walk around in meadows.” (Volkskrant, August 3, 2013)

Current animal products were also compared to replacement products in terms input-output ratio: how much plant-based material is needed to produce a kilogram of insects compared to a kilogram of beef.

“According to prof. dr. ir. Arnold van Huis, entomologist at the Wageningen University, insects are our saviours in distress. In 80% of the countries insects are eaten. They emit less greenhouse gases and ammonia than conventional livestock. They convert their feed very efficiently into body weight because they are cold-blooded and therefore don't need feed to stabilize their body temperature.” (Telegraaf, March 30, 2013)

Furthermore, the newspapers presented statements from research-related actors who evaluated replacement products in terms of technological and financial feasibility, food safety, nutritional value and public acceptance. For example, in the Volkskrant researcher Mark Post discussed the technological and financial feasibility of in-vitro meat.

“It's an imperfect product; Post himself is the first one to admit this. And the costs are astronomical: over two tonnes per hamburger of 100 grams. But the point is to prove that it is technically possible to cultivate meat. The applicability is the next step. Post does not worry about the acceptance. 'If you can make people eat frikandels, everything is possible.'[...] If my financier puts invests money, it can be achieved within ten years.' The technology exists.” (Volkskrant, September 3, 2013)

The newspapers used research to problematize current livestock production, to emphasize the benefits of replacement products, and to evaluate the challenges with regard to these new products. Scientific and commercial research was found to be the most important source of information, explanations and calculations on this matter. Indirect references to research(ers) were hardly ever made. Furthermore, statements regarding these product replacements were hardly ever challenged. Only the Volkskrant contradicted an earlier statement about the sustainability of meat replacement product Valess, and discussed the usefulness of in-vitro meat when plant-based replacement products are already available. Nevertheless, in general these replacement products received positive attention.

6.4 Issue-frame 3: Governance

Frame description

In 31 (27%) of the Volkskrant articles and 5 (10%) of the Telegraaf articles livestock's role in climate change was defined as a problem of governance. Livestock related greenhouse gas emissions were attributed to social and political structures. For example: the subsidisation of unsustainable (animal) production, and a lack of political support for sustainable production and consumption. This frame contained a moral obligation towards national and international governmental bodies to make decisions and to take action. Accordingly, the following treatment recommendations were proposed: introduction of market-based mechanisms to stimulate sustainable consumption and production (e.g. a meat tax), introduction of voluntary behaviour mechanisms (e.g. product information labels), changing current market-based mechanisms (e.g. removing subsidies on livestock production), and introducing performance-based standards (e.g. standards for animal housing). International agreements like emission rights trade were also mentioned. This frame was more prevalent in the Volkskrant than in

the Telegraaf. The newspapers did not make (clear) political statements themselves. Instead, they functioned as a stage for societal actors and their political views (e.g. politicians and citizens).

“A green world does not start with green products or green consumers. It starts with green politics. Therefore people have to trust less on their power as consumers and behave more as citizens or activists. A single prohibition on a single product is not enough. It is necessary that along the entire chain the polluter pays.” (Pieter Hilhorst, columnist in the Volkskrant, September 8, 2009)

Research in the governance frame

The role of research within the governance frame was not as prominent as in the other two frames. Especially the Telegraaf paid little attention to research within this frame, the Volkskrant a bit more. Table 6 provides an overview of the objective conditions, sources, and functions of research within the governance frame. The reference numbers correspond to those in appendix 3.

Table 6 Research in the governance frame

Objective conditions	Volkskrant sources	Telegraaf sources	Function
1. Global and national emissions from production to consumption	3, 4, 12, 13, 20, 28, 32, 47, 75,	2	Problematization of livestock emissions Emphasize urgency for governmental interference
2. Emission sources	13, 47, 78, 79, 89		Explanation emission sources
3. Expected increase in demand for animal products	12, 13, 20, 32, 56	4	Emphasizing urgency of the problem
4. Current manure policy and climate impact		1, 10, 21	Re-evaluation of current policy
5. Potential reduction demand animal products following tax increase	30, 50, 68		Emphasize benefits of meat tax
6. Potential increase emissions following liberal political scenario	29, 85		Emphasize importance of EU regulations
7. Consumer behaviour & opinion	24, 31, 47		Question voluntary consumption change, demand governmental interference

Objective condition 1: Global and national emissions from production to consumption

Similar to the other issue-frames, within this frame the newspapers included quantitative research results about the share of global and national livestock emissions in the total amount of greenhouse gas emissions. Additionally, these results were presented in comparison to emissions from the traffic/transport sector. Such research findings were mostly mentioned indirectly by politicians, citizens and (politically oriented) researchers to emphasize the problematic nature of livestock emissions and to urge the need for action and/or political interference. They did not always use clear quantifications, but rather acknowledged the ‘large’ role of livestock farming in climate change. For example, in the Volkskrant Marianne Thieme used quantifications from the Food and Agriculture Organisation of global emissions (18%) to emphasize the need for politician interference. In contrast, in the Telegraaf Ger Koopmans used national emission rates to challenge the need for governmental interference.

““Off course”, says Koopmans. “A billion people in China and India don’t have a car, but a cow, sheep or pig. To survive. The Netherlands knows other numbers. Traffic and transport emit 76 percent of our greenhouse gases, the livestock sector 13 percent. But those numbers aren’t mentioned by Thieme.” (Telegraaf, December 14, 2007)

Conclusions and recommendations of research reports commissioned by the government or performed by public research organisations like the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency) touched upon governmental topics like the introduction of a meat tax. Especially research results from public research organisations on current emissions and consumption were used to emphasize the problematic situation and call for governmental interference. Furthermore, in the Volkskrant several researchers appeared as speakers on this matter. For example, Maarten Hajer from the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency) proposed market-based interference to reduce meat consumption, based on the general outcomes of the report The Protein Puzzle which included expected consumption increase and current emission rates. Research statements were sometimes focussed more on politics and opinions than research. For example, professor of Food Policy Tim Lang stated that the current way of producing is coming to an end and governments should subsidise fruit and vegetables instead of animal products like meat. CLM researcher Wouter van der Weijden criticized Minister Verburg’s ‘neoliberal’ approach.

Objective condition 2: Emission sources

Within this frame the newspapers and speakers mentioned several emission sources: deforestation, input-output ratio of meat production, enteric fermentation of ruminants, (over)consumption of animal products. These identifications of emission sources were not always based on research. Nevertheless, these sources were discussed more elaborately in the Volkskrant when the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency) published reports like the Milieu- en Natuurbalans 2009 (Environment and Nature Balance), and when the results from research performed by Blonk Environmental Advice were discussed by politicians. These research results were used to explain why livestock farming results in greenhouse gas emissions.

Objective condition 3: Expected increase in demand for animal products

The newspapers and speakers within the newspapers discussed prognostics regarding expected increase in demand for animal products, which are initially based on research. Usually this was done by providing an estimated increase by 2050. This expected increase in demand for animal products functioned as a statement to emphasize the potential aggravation of the problem. A clear reference to a source was not always provided. Research results from reports published by the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency) were used as additional sources, not only the Food and Agriculture Organisation or United Nations.

Objective condition 4: Current manure policy and climate impact

The Telegraaf reported on claims made by researchers about the ineffectiveness of below-ground manure injections. Peter Takens, not a researcher but someone involved in a project about

sustainable soil management, explained that mandatory manure injections lead to soil degradation and the emission of nitrous oxide (which is more damaging than carbon dioxide). He referred to tables from the RIVM (National Institute for Health and the Environment) and was reported to be supported by Wageningen UR researchers. The newspaper used these statements to reevaluate Dutch policies.

Objective condition 5: Potential reduction demand animal products following tax increase

In the Volkskrant, CE Delft researchers Martijn Blom and Maartje Seventer presented a calculation about the expected effect of tax increase on the demand for animal products and CO₂ emissions. The researchers used this calculation to emphasize the need for a meat tax.

“How much the demand for meat drops when prices are increased depends on the price sensitivity of consumers. Estimates differ per country and type of meat, but an increase of the tax rate to 19 percent would roughly lead to a decrease in demand of about 9 percent. This would result in a reduction of about 1.1 megatons of CO₂, comparable to the effect of the future kilometre tax.” (Volkskrant, August 21, 2007)

Objective condition 6: Potential increase emissions following liberal political scenario

According to the Nationale Milieuverkenning 2006-2040 (National Milieu Exploration) and researcher Annemarie van Wezel, if the government would take a liberal approach towards sustainability the dairy sector would increase production and cause ammonia and methane problems. These problems were claimed to be currently limited because of European regulations. These findings were presented by the Volkskrant in an article mainly focussed on the report.

Objective condition 7: Consumer behaviour & opinion

The Volkskrant included several research contributions about consumer behaviour and opinion. First, the newspaper discussed the result and conclusion from the Duurzaamheidsverkenning (Sustainability Exploration) from the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency) that 70% of the Dutch citizens want the government to solve environmental problems, that a lack of sustainable consumption is not caused by a lack of environmental consciousness but income rise, and that income rise can expand emissions in the future. This organisation therefore suggested the introduction of a meat tax. The newspaper presented these results and conclusions not as fact, but as the point of view of the organisation. In a column the chief of the financial redaction of the Volkskrant, Fokke Obbema, reported on the conclusion from a research performed by Mark van der Veen on consumer behaviour was also mentioned, he found that sustainability of products does not influence buying behaviour. Therefore he argued that political interference is needed.

“Environmental friendliness appears not to weigh in, observed scientist Mark van der Veen who studied consumer behaviour at sixteen Dutch companies. His conclusion is that only through stricter legislations the purchase of sustainable products can be stimulated. For example: Akzo Nobel could only launch a new, environmentally friendly paint after the European norms were tightened. Without this governmental help it did not work.” (Volkskrant, September 6, 2008)

6.5 Recap & Conclusion

According to social problems theory people do not necessarily worry about objective conditions (what happens in the world) because they might be unaware of these conditions, or do not perceive them as 'wrong' (Schneider, 1985; Loseke, 2011). The actual contribution of livestock farming to climate change did not necessarily have to lead to a problematization in newspapers. Nevertheless both newspapers did construct livestock-related emissions as problematic and undesirable: something to worry about. Moreover, the newspapers used research contributions to do so. Research contributed to the general understanding of the existence, gravity and urgency of the problem. Moreover, it was used to make the problem socially relevant and to involve the newspaper audience. The newspapers framed the issue in terms of consumption & lifestyle, production & supply, and governmental interference. Within these frames research was used to make sense of greenhouse gases, emissions, sources of emissions, socio-economic processes influencing these emissions, and mitigation options. The newspapers sometimes used sources to support multiple frames. Research was used to identify and evaluate mitigation options along the entire livestock production chain, from animal feed production to the consumption and waste of animal products. Research was influential in introducing and evaluating solutions, and emphasizing complexity and uncertainty into newspaper coverage. Research contributions were not able to settle all discussions (e.g. organic vs. conventional). However, it did contribute to these discussions by providing arguments and challenging statements made by (non-research) speakers. Citizens and celebrities were considered knowledgeable with regard to sustainable consumption in everyday life and several political speakers were presented as knowledgeable with regard to governmental interference. However, with regard to farm level mitigation almost no farmers were presented as knowledgeable. Some research findings developed into more 'common' knowledge. In this process initial research information was sometimes transformed into a statement with a somewhat different meaning. Furthermore, research was used strategically by societal actors in the discussion about the sustainability of livestock systems, concealing the moral arguments on which it is largely based. Research contributions were presented as true and trustworthy and were hardly ever questioned.

Table 7 Focus, function and limitations of research in Volkskrant and Telegraaf content

Focus	Function
<ul style="list-style-type: none"> • Emission rates (global, national, per product) • Emission source identification & explanation • Current consumer behaviour & opinion • Expected increase demand for animal products • Sustainability & feasibility systems and products • Technological & managerial mitigation innovations • Current & potential impact political interference 	<ul style="list-style-type: none"> • General problematization • Involving readers • Contributions to common knowledge • Proposing solutions • Evaluating solutions • Providing consumer advice • Challenging (incorrect) statements
Limitations	
<ul style="list-style-type: none"> • Incorrect rephrasing of research results, • Inclusion of contradicting information 	<ul style="list-style-type: none"> • Limited contribution in governmental debate • Limited contribution in moral discussion

7. Results Research Question 3: Newspapers vs. Science

This chapter provides the answer to the third sub-question: “To what extent did newspaper coverage mirror scientific debates on livestock farming as a driver of climate change?” The newspaper analysis provided insight into the uptake of research within newspaper coverage. Scientific literature was reviewed and three experts were interviewed to explore scientific debates on the matter. In paragraphs 7.1 and 7.2 similarities and differences between newspaper coverage and scientific debates are described. Sub-question 3 is answered in paragraph 7.3 Quotes from the experts are included in blue.

7.1 How Newspaper Coverage Mirrored Scientific Debates

Identification of the problem

The first point on which newspaper coverage resembled scientific debates was the identification of a problem. Within the scientific community there is a general consensus that livestock farming contributes to climate change through greenhouse gas emissions, and that this is problematic. This problematic situation has been scientifically identified by means of greenhouse gas measurements. The newspapers acknowledged this problematic situation and used greenhouse gas measurements to do so. Moreover, in both newspapers the issue was hardly ever questioned. This suggests there is general consensus about the existence of the problem and its undesirable nature. Furthermore, the newspapers mirrored scientific debates in terms of acknowledging the relatively low emissions (i.e. per unit of product) from the Dutch sector compared to the global sector in general.

As explained in chapter 2, sources of emissions can be identified along the entire livestock chain from production to consumption. Chapter 6 showed that the newspapers mentioned a wide variety of emission sources. The following types of greenhouse gas emission sources known in science were mentioned in the newspaper data: consumption and waste of animal source food, fertilization of soils, manure management, enteric fermentation of ruminants, deforestation/land use change (biomass burning), energy use, and transport of animal products.

Development & evaluation of solutions

The second point on which newspaper coverage resembled scientific debates is the emphasis on mitigation options. Both in science and in the newspapers the development of mitigation options received much attention.

“Look, ascertaining the existence of the problem is one thing, but to say what we should do next, which solutions will you come up with, that’s something else.” (Interviewee T.V. Vellinga, personal communication, June 23, 2015).

The scope of potential mitigation options known in science is broad. Possibilities for greenhouse gas emission reductions can be found along the entire livestock chain from production to consumption. Not all mitigation options from appendix 1 were mentioned by the newspapers. However, the following mitigation options known in the science were found within the newspaper data: consumption change, waste reduction, reduction of transport, energy production from solar power or animal residues, improving feed efficiency, feeding additives, bacterial changes in the rumen, and conservation of existing carbon pools (forests). Additionally, the newspapers discussed possibilities of (partly)

replacing the current livestock system and turning to other types of products like in-vitro meat. Furthermore, the newspapers paid attention to possibilities of governmental interference. The newspapers placed particular emphasis on mitigation options related to consumer behaviour and income (e.g. meat tax). Furthermore, relatively much attention was paid to innovative or 'strange' mitigation options in production, like the development of in-vitro meat, or transporting bacteria from kangaroos to cows. And finally, mitigation options that touched upon other issues like animal welfare or public health were highlighted by the newspapers. Both in science and in the newspapers animal welfare and public health are taken into consideration. As discussed in chapter 6, the newspapers framed livestock's contribution to climate change in terms of consumption, production, and governance. In general, none of these frames conflict with scientific knowledge. In some parts of the world consumption change is considered possible and beneficial, as are improvements in production systems and governmental tools.

The newspapers evaluated mitigation options mostly based on their emission reducing potential. Furthermore, animal welfare, food safety, technological and financial feasibility and public acceptance were mentioned as criteria for successful mitigation options. These criteria are also considered important within science. Therefore, with regard to these criteria newspaper coverage mirrored scientific evaluation criteria.

Discussion and debate

Scientific discussion exists about greenhouse gas emission measurement methods, calculations and models. These discussions are about the credibility and accuracy of measurement designs and corresponding results. Although the newspapers did not actively report on these discussions, the Volkskrant did include a statement from one scientist on the calculation of another. Both newspapers paid attention to the discussion about the sustainability of organic versus conventional/intensive livestock farming. These production systems were compared in terms of emissions, energy use, manure production, and animal welfare. Although research was used within this discussion, it was unable to provide conclusive answers about which system is more sustainable. The experts explained that within the scientific community there is also no conclusive answer to which system is more sustainable. Some scientists support organic livestock farming, others promote intensive livestock farming, and yet others emphasize the need for more collaboration between the two. General consensus exists that organic is not necessarily more climate friendly. In the past, scientific insights have led to governmental decisions like mandatory below-ground manure application on soils (i.e. to reduce ammonia emissions). However, news insights from research have challenged the sustainability and effectiveness of these options with regard to other environmental impact categories (e.g., climate change), leading to discussion. In general, the newspapers paid little attention to re-evaluations of mitigation options. However, the Telegraaf did publish one article on the scientific debate regarding manure application methods.

Sources & references

The Telegraaf and Volkskrant referred to a wide variety of national and international research institutes, calculations, reports and statements. Appendix 3 provides a complete overview of the references found within the data. Different types of research were covered: social, technological, biological, chemical, animal etc. This generally touched upon the broad scope of research focus areas surrounding the issue. Clearly the research input for newspapers was not merely scientific. One of the experts explained that in science researchers often use each other's data. In the newspaper coverage it was found that indeed organisations and researchers sometimes referred to data from others. Discussion and debate are generally considered positive aspects within science. Hence, through critically assessing each other's work the quality of scientific knowledge can be improved. Both newspapers included statements by scientists with conflicting perspectives on the sustainability of the Dutch livestock sector, the sustainability of different (animal products), and the feasibility of vegetarian consumption. Furthermore, the newspapers took over the sceptical view on the documentary Meat the Truth from the Partij voor de Dieren (Party for the Animals). In science the credibility and validity of this documentary was also questioned.

7.2 How Newspaper Coverage Diverged from Scientific Debates

Identification of the problem

The first point on which newspaper coverage diverged from scientific research was the moment it started to pay attention to the issue. As discussed in chapter 5, newspaper attention to livestock farming as a driver of climate change increased considerably after 2006. In previous years the topic received little or no attention from both the Telegraaf and the Volkskrant. However, scientific attention to the topic started long before 2006. According to all three experts, research on livestock farming as a driver of climate change took place before 2000 (1990-1999). In the 90's measurements on methane, carbon dioxide and nitrous oxide took place. This included measurements on emissions from manure/fertilizer application, land use change and enteric fermentation of ruminants. Furthermore, scientifically speaking a lot of attention has been paid to the development of measurement tools, calculations, and models to accurately estimate greenhouse gas emissions. Although both newspapers did include results from these estimates, the actual measurements and tools to estimate emissions received little attention. Moreover, the newspapers often presented emission rates as facts instead of research results. This diverges from the emphasis put on the inaccuracy and complexity of these calculations by scientists.

"Talking about climate things in general, I think there are enough scientists who don't agree with each other [...] about whether it is going like this or that. Especially because there are many influential factors to consider. So it is very difficult to say who's right. Because to some extent they are all right." (J.W. Snoek, personal communication, June 16, 2015).

Results from the Food and Agriculture Organisation that were used by both newspapers are considered credible within science. Still, in the meantime this Food and Agriculture Organisation has re-adjusted the initial percentage of livestock emissions from 18% to 14.5% (or rounded to 15%). This re-adjustment was not mirrored in newspapers.

Newspapers did compare the national livestock sector to the global livestock sector in terms of emissions. Moreover, they used research results to do so. However, in science the Dutch livestock sector is also put in perspective to other countries in terms of its size. For example, according to one of the experts, 50% of all pigs are in China. And a country like India has 200 million cattle and 100 million buffaloes while the entire European Union only has 190 million cattle. The newspapers applied a very national focus in which global emissions were sometimes attributed to the national sector, and did not pay much attention to the small size of the Dutch livestock sector compared to other livestock sectors. Furthermore, the newspapers did not mirror the scientific research agenda focussed on developing countries. In these countries greenhouse gas emissions from the livestock sector are accompanied by a lack of food security and employability. The newspapers did not focus on these problems. Instead they rather employed a national or western focus in which public health and animal welfare received attention. Finally, the newspapers did not pay any attention to regional differences in emissions. Livestock emission rates differ between regions within the Netherlands. Research has been performed on these regional differences, but did not receive newspaper attention.

Although the newspapers covered a wide variety of greenhouse gas emission sources within the livestock sector, the following types of emission sources were not included: crop residue management, fertilizer manufacturing, production of non-crop animal feed (e.g. synthetic amino acids), production of cleaning agents, and packaging. The most important sources of greenhouse gas emissions were mentioned by both newspapers (enteric fermentation, manure management and feed production). However, the newspapers did not go into these sources in much depth. For example, deforestation was mentioned but other types of land use change were not, energy use was mentioned but different types of on-farm and off-farm energy use were not discussed (e.g. climate control in stables and use of fuel during animal feed production)

Development & evaluation of solutions

As discussed in paragraph 7.1, the newspapers mentioned a wide range of mitigation options. In this sense newspaper coverage mirrored the broad scope of mitigation options found in science. However, the following mitigation options generally known in science were not discussed by the newspapers: carbon sequestration in soils, improved grass or fodder crop management (e.g. crop and grass varieties, grazing management), improved soil management, improved animal breeds, and manure storage and processing. Interestingly, improved animal housing systems did not receive much attention in the newspapers, even though this mitigation option touched upon aspects of animal welfare. Only in two Volkskrant articles an unclear reference to the potential benefits of keeping cows inside was made.

The newspapers framed the issue in terms of consumption, production and governance. In general, these frames agree with scientific perspectives on the issue. Hence, all frames contain mitigation options which are considered potentially beneficial in science. However, the newspapers sometimes presented the mitigation options within these frames as a panacea (a solution for the entire problem and other problems). In this sense newspaper coverage diverged from scientific debates. Following

the expert reactions, in science the incapability of individual mitigation options to solve the entire problem is acknowledged. For example, consumption change is considered beneficial, but also limited.

“When we, in Northern-America, Europe, Australia and New-Zealand, halve meat consumption than still the global consumption of meat and dairy products will increase. Hence, the consumption rise in other parts of the world is so big that it will not be balanced by this. And so it is not a matter of eating less meat or increasing livestock efficiency...no, you have to do both. In which you have to place emphasis on different aspects in different places.” (T.V. Vellinga, personal communication, June 23, 2015)

Newspaper coverage very much focussed on mitigation within the Netherlands. Few references were made to mitigation in other countries. In science a more international focus was found. In Western countries reduced meat consumption is considered feasible and potentially beneficial. However, in developing countries other mitigation options are regarded feasible in science. For example one of the experts mentioned sustainable intensification, which refers to improved efficiency and livestock system development which meets demands both with regard to sustainability (mitigation) and food security.

Another way in which newspaper coverage did not mirror scientific debates is the criteria used to evaluate mitigation options. The newspapers did include research results on potential emission reductions, land and energy use, efficiency, political applicability and public acceptance. Furthermore researchers appeared as speakers in newspaper coverage to explain the technological and managerial aspects of mitigation options. However, the newspapers did not pay attention to the following evaluation criteria found in science. First, no attention was paid to the possibility of increasing emissions from one greenhouse gas while trying to decrease emissions from another. For example, nitrous oxide and carbon dioxide emissions from feed production could increase when a new feeding strategy is used to reduce enteric methane emissions. Furthermore, the durability/sustainability of mitigation options was not discussed (e.g. long term effectiveness of animal feed additives). Scientific discussion exists about whether soil carbon sequestration is still sustainable when soils are ploughed within several years. This discussion was not found in the newspaper content (in fact, no statements were made about soil carbon sequestration at all). Finally, hardly any attention was paid to the impact of mitigation strategies on the productivity or profitability for farmers. In one Volkskrant article a researcher mentioned the possibility of reduced methane emissions and increased milk production following improved animal feed.

Discussion and debate

As newspapers did not pay much attention to the development of emission measurement tools and calculations, they also did not pay attention to discussions about their accuracy. Few statements were found in which a calculation was questioned, while in science more discussion exists. Furthermore, the newspapers only mentioned one discussion about the sustainability of mitigation options: manure application. For example, discussions about emission reducing stable floors and the long term effectiveness of carbon sequestration in soils were not covered. As discussed in chapter 6, newspaper coverage contained a discussion about the sustainability of current (intensive/conventional) livestock systems and organic or small-scaled livestock systems. In science some scholars prefer and focus on organic systems and others on conventional systems. However, in the de-industrialisation frame

claims were made which did not mirror scientific perspectives. For example, statements in which small-scale agriculture was argued to be more sustainable do not mirror a general scientific perspective. There is a general consensus within science that organic agriculture is not necessarily more sustainable. Although scientific debates about whether the limits of intensification have been reached (in the Netherlands), the de-industrialisation frame seemed to mirror scientific debates less than the innovation frame.

Sources & references

It is impractical to mention all research sources that were not included in the newspapers because there are so many.

"I think you could better sum up the people who do not deal with the issue than the ones who are. You could say that every livestock club pays attention to greenhouse gases." (T.V. Vellinga, personal communication, June 23, 2015)

Nevertheless, the experts were asked to mention influential research organisations or individual researchers. The following sources were mentioned but did not appear in newspaper coverage: Global Research Alliance on Agricultural Greenhouse Gases, Directorate-General for the Environment, Directorate-General for Climate Action, Alterra, The Environmental Science Group (Wageningen UR), Plant Research International, Food & Biobased Research, Pete Smith (a scientist focused on carbon sequestration), Jean-Francois Soussana (working at the French National Institute of Agricultural Research), Martin Scholten (Animal Science Group Wageningen UR), and Harry Clark (New-Zealand Agricultural Greenhouse Gas Research). As mentioned before, newspapers were found to have a very different reference style than those commonly used in science. Moreover, both newspapers often did not refer to authors of a study or the publisher of a study. Sometimes only the commissioner was mentioned, or the scientific institute to which the researchers belonged (e.g. Wageningen University).

Within the scientific community often multiple research organizations and projects are working on the same topics. This is considered important because they can create room for discussion and criticize and evaluate each other's work. However, different research projects often result in (somewhat) different findings, which can make it difficult to provide conclusive answers. The newspapers did not include multiple findings on the same topic, unless they were very contradictory. It was found that both newspapers did provide room for research actors to contradict statements made by other societal actors. For instance, Aalt Dijkhuizen and Rudy Rabbinge appeared as speakers in the Telegraaf to contradict statements made by the nongovernmental organization Wakker Dier (Animals Awake). Another point on which newspaper coverage diverged from scientific debates was the criteria used to describe/explicate the credibility of sources. The experts confirmed that in scientific debates the credibility of research is evaluated based on independence from the research commissioner, objectivity, and the absence of a hidden agenda. In the newspapers sometimes the commissioner of a research was mentioned, but the credibility of research results was not made explicit or explained to the newspaper readers regarding any of the criteria mentioned above. One of the experts also

questioned the objectivity of CLM, but the newspapers did not provide any sign of incredibility towards this commercial research agency. One final note on this point, one of the experts pointed out that although the report Livestock's Long Shadow from the Food and Agriculture Organisation of the United Nations contained much information about all aspects and problems within the global livestock sector, especially much attention was paid to the part of the report about emissions and climate change.

Table 8 Overview of similarities and differences between science and newspaper coverage

Points of comparison	Similarities	Differences
Identification of the problem	<ul style="list-style-type: none"> • Acknowledgement of problematic situation • Focus on greenhouse gas emissions • Comparison global-national emissions • Identification of emission sources along entire livestock chain from production to consumption 	<ul style="list-style-type: none"> • Newspaper attention started later • Newspapers paid little attention to the development of emission measurement tools • Science pays more attention to limitations and uncertainties of calculations and measurements • Newspapers did not mirror re-adjusted research results • Newspapers did not compare size Dutch livestock sector to foreign livestock sectors • Newspapers applied rather national approach, in science more international approach • Newspapers did not pay attention to regional differences • Several emission sources were not included by newspapers
Development and evaluation of solutions	<ul style="list-style-type: none"> • Much attention to mitigation options • Identification of mitigation options along entire livestock chain from production to consumption • Attention to animal welfare & public health • Evaluation criteria mitigation included in coverage: emission reduction potential, animal welfare, food safety, technological and financial feasibility, public acceptance and political applicability 	<ul style="list-style-type: none"> • Several mitigation options were not included by newspapers • Animal welfare statements in newspapers not often based on research • Newspapers paid little attention to limitations of mitigation options • Evaluation criteria mitigation not included in newspaper coverage options: emission shifts, durability, implications for farmers
Discussions and debate	<ul style="list-style-type: none"> • Discussion conventional vs. organic • Attention to conflicting statements • Re-evaluation of policy on manure application 	<ul style="list-style-type: none"> • Little discussion on accuracy of measurement tools in newspapers • Little discussion about feasibility mitigation options in newspapers • Arguments in the de-industrialisation frame in newspapers
Sources and references	<ul style="list-style-type: none"> • Wide variety of research institutes, individuals, reports, and statements included • Social, technological, biological, chemical, animal aspects discussed • Sceptical view towards Meat the Truth documentary 	<ul style="list-style-type: none"> • Newspapers draw conclusions based on few sources • Newspapers did not pay much attention to credibility of sources • Newspapers did not use scientific reference style

7.3 Recap & Conclusion

News media create a mediated reality that does not necessarily reflect objective reality, nor scientific reality (Weingart, 1998; Scheufele, 2014). This selection and representation of research has implications for how newspaper readers have been informed about the issue. The results of this chapter showed that indeed newspaper coverage did not entirely reflect scientific reality. The results suggest that in general newspaper coverage did reflect scientific consensus with regard to the existence of the problem, the urgency of the problem and broad scope of potential mitigation options along the entire livestock production chain, up to consumption. Furthermore, the newspapers included research from a wide variety of institutes and focus areas (natural science, social science, animal science etc.), reflecting the broad scope of research institutes working on the topic. The newspapers did not often use several sources for the same conclusion, but did pay attention to conflicting statements made by research-related actors and non-research related actors. The results also suggest that both newspapers tended to select research that appeared to be relevant to citizens (e.g. through consumption or governmental interference), research focussed on new or 'strange' innovations (e.g. an anti-flatulence pill or breeding insects for human consumption). Although the newspapers did connect livestock's role in climate change to problems with animal welfare, little research was used to do this. Furthermore, the newspapers applied a quite national focus with regard to mitigation options, but still often used global emission data which appears more problematic. The newspapers paid more attention to research results (e.g. emission rates) than the research processes (e.g. the development of measurement tools). Moreover, mitigation options were assessed by different criteria in newspaper coverage than in scientific debates. Finally, the results from this chapter show that the topic did not received much attention until several years after the issue received scientific attention. This could be because no comprehensive reports with political implications existed yet, because no interaction with the media took place, or because the media did not regard it relevant or interesting to be communicated to its readers. Nevertheless, in general newspaper coverage did mirror the basic understanding of the issue found in science.

"As I said earlier it is already nice when people know agriculture contributes to greenhouse gas emissions in the first place. And whether the livestock sector contributes 10, 13 or 18 percent, I wonder if this is really interesting for the bigger audience. (R.L.M. Schils, personal communication, June 17, 2015)

8. Conclusion & Discussion

This chapter constitutes the final part of this report. A review of the study and an overview of its results are provided. Furthermore, the conclusions and (theoretical) implications of the study are discussed.

Review & results

This study aimed to increase our understanding of the contributions and limitations of research in Dutch newspaper coverage on livestock farming as a driver of climate change. It was designed to answer the following research question: *"How did research contribute to Dutch newspaper coverage on livestock farming as a driver of climate change between 2000 and 2015?"* Social problems theory and framing theory guided the qualitative content analysis of 162 Telegraaf and Volkskrant articles. Three experts were interviewed to compare newspaper coverage to scientific debates. In short, the results of this study suggest that research was an important or even essential contributor to the subjective understanding of livestock farming as a driver of climate change within newspaper coverage. Although mediated reality did not mirror scientific/researched reality, the essence of the stories matched. The selection and representation of research contributed to a fairly balanced representation of the actual problematic situation in newspaper coverage. These findings are important because they highlight the importance of research-media interactions and shed light on how Dutch newspaper readers have been informed about the issue. Furthermore, they reveal an active and positive interest from Dutch newspapers in research as a source of knowledge to inform and entertain their audience. More elaborately, the results of this study suggest that between 2000 and 2015 the Telegraaf and Volkskrant attributed a prominent and permanent role to research with regard to livestock farming as a driver of climate change. Not only scientific, but also other types of research were legitimized as sources of knowledge, providing information about natural, technological and social aspects of the issue. Most attention was paid to research results and conclusions, and less to methodological aspects and the uncertainty of research findings, unless when ongoing innovative research projects were covered. Indirect references to research from speakers suggest there has been an active public and political interest in (research on) the topic. Research contributed to the problematization of livestock emissions in terms of consumption, production or governance. Furthermore, research was used to emphasize the gravity and urgency of this problem, to make moral evaluations, involve readers, propose solutions, evaluate solutions, and to provide consumer advice. Research was represented indirectly by speakers to problematize livestock emissions, to support one of the frames, to make moral evaluations, and to propose particular solutions. Research findings and research statements contributed to discussion and debate by emphasizing complexities and uncertainties surrounding the topic, by providing arguments to support political statements, and by evaluating statements made by other (societal) actors. Generally, research contributions were presented in a positive and uncritical way, suggesting their facticity. Statements from researchers on the limitations of their own or each other's projects were sometimes included. Furthermore, political statements made by research-related actors did received some (but little) criticism by other societal speakers. The outcomes of this study reveal several limitations of research as a contributor to newspaper coverage. Research did not necessarily receive newspaper attention unless it was socially or politically relevant, new or 'strange'. Furthermore, the newspapers included statements in which research findings were

incorrectly or strategically used by social actors. Some old research results received more attention than updated versions and sometimes previous research statements were ignored and replaced by (incorrect) contradicting statements. Both newspapers did not include many statements regarding to the credibility of sources or limitations of findings. In this case comments made by researchers and other actors challenging earlier statements proved to be of great importance. Finally, research did not always provide definite answers to questions and was unable to settle (moral) discussions. This suggests that knowledge from research alone was unable to guide social engagement.

Theoretical implications of research results

The results of this study match many theoretical assumptions from chapter 3, but also bring about new theoretical insights. First of all, the results match the idea that science is an important source of knowledge about complex environmental problems and can contribute to the public understanding of these problems, at least in the newspaper context (cf. Scheufele, 2014; Summ & Volpers, 2015; Taylor & Buttel, 1992; Weingart, 2002). However, the results of this study suggest that a focus on 'science' is insufficient. Hence, within the newspaper context other types of research are considered legitimate and important sources of knowledge as well. To some extent this study supports the idea that in light of complex problems the borders between science, policy and society become less clear (cf. Weingart, 2002). Hence, research contributions within the newspapers were not limited to research, but touched upon social and political discussions as well. Research findings were often strategically used by (social) actors to support their statements, which suggests research became politicized within the newspaper context (cf. Carvalho, 2007; Fischer, 2003; Pepermans & Maesele, 2014; Weingart, 2002). To a limited extent they were also publicly evaluated, which partly confirms the idea that when research becomes politicized it becomes subject to criticism and contestation (cf. Weingart, 2002). However, generally research contributions remained unchallenged and research findings were 'validated' into facts or common knowledge by the newspapers (cf. Gamson, 1999). This does not mirror findings from Boykoff & Boykoff (2007), who found that in US press coverage sceptical views, uncertainty and scientific disagreement were emphasized. It shows more resemblance to findings from Summ & Volpers who found that in 2015 German newspaper presented science as uncontroversial, that science was judged positively, and that articles were often based on only one source (cf. Hijmans et al., 2003). To some extent they also match findings from Weingart et al. (2002) who found that German newspapers ignored uncertainties and reported on climate change in an affirmative manner to emphasize the problem and to call for action. However, Dutch newspapers also used research findings to nuance statements about the impact of the Dutch livestock sector compared to the global livestock sector. The lack of attention to scientific uncertainty and methodological aspects corresponds to findings from Hijmans et al. (2003) regarding science reporting in general in Dutch newspapers. Possibly journalists considered statistics and uncertainty to be problematic concepts for readers and wanted to avoid complex information (cf. Hijmans et al., 2003, p.171). However, in the present study it was found that when conflicting research findings touched upon public discussions like intensive vs. organic agriculture (which also relates to animal welfare), methodological aspects were discussed to evaluate who is right. Thus, neither was newspaper coverage overly critical, nor was it completely

affirmative (although it was more affirmative than critical). Pepermans & Maesele (2014) argue that some scholars assume that media coverage on climate change science should present consensus and scientific accuracy, and that discussion and debate are something to overcome. Pepermans & Maesele (2014, p.220) criticize this perspective because “a well-functioning democracy needs a clash of legitimate political positions that offer forms of collective identification with clearly differentiated democratic positions”. They argue that rational and accurate newspaper coverage might result in less public and political engagement. The results of this study suggest that both perspectives are relevant. The newspapers presented a general consensus regarding the problematic nature of livestock emissions, which proved to be an important starting point for the legitimization of mitigation strategies. However, the newspapers did present broader and sometimes more conflictive perspectives on which mitigation strategies were considered suitable. With regard to mitigation the newspapers provided space for differentiated democratic positions, which might be crucial for public involvement. For example, the politically oriented documentary *Meat the Truth* triggered reactions from research on the accuracy and credibility of this documentary, which were included by the newspapers. This discussion did not only result in newspaper attention to the topic, but in more in-depth reporting on the matter as well. Research on livestock emissions started long before the issue received considerable newspaper attention. It was found that newspapers tended to focus on research when it was socially/politically relevant (e.g. in response to the *Meat the Truth* documentary), when perspectives on the matter conflicted (e.g. organic vs. conventional/intensive agriculture) and when new or ‘strange’ things were developed (e.g. in-vitro meat or pills to reduce cow ‘farts’) (c.f. Dunwoody, 2008). In this study a broad definition of science was applied: not only focussing on science sections of newspapers or merely science-oriented articles, but on scientific contributions in all parts of the newspapers (Summ & Volpers, 2015; Wormer, 2008). This proved to be important. Although some scientific innovations were discussed in a science-oriented way, most references to research appeared in other (news) sections of the newspapers as part of one of the three issue-frames.

Social problems theory was applied in this study to explore how newspapers represented research as a source of knowledge about objective conditions within subjective definitions (Loseke, 2011). In general this proved to be a suitable approach because research was found to be an important source of objective conditions. However, it became clear that the role of research was not bound to its focus on objective conditions. Instead, in line with the scientization of politics (Weingart, 2002) research contributions touched upon moral evaluations and social and political implications. In general the theory of framing proved to be a good starting point for the analysis of newspaper issue constructions. Entman’s definition was successfully applied, resulting in frame descriptions including problem definitions, causal interpretations, moral evaluations and treatment recommendations (Entman, 1993). Nevertheless, the frames that were found in the newspaper analysis (consumption, production, and governance) do not do justice to the multiplicity of points of view within these frames. For example, in the production frame three different types of solutions were mentioned: innovation, de-industrialisation, and product replacement. If the study would have focussed on the production frame alone, these (sometimes conflicting) types of solutions could be identified as issue-frames as such. Therefore the issue-frames found within this study must be seen as general issue-frames, rather than very specific

issue-frames. These general issue-frames were not mutually exclusive within articles, which suggests that the newspapers rather provided a broad overview of perspectives rather than excluding some of these perspectives. Nevertheless, the consumption frame did receive much attention, a frame that puts emphasis on citizens rather than (technological) researchers.

Implications for practice and further research

From a scientific point of view the Telegraaf and Volkskrant presented a generally correct and complete picture of livestock farming as a driver of climate change and research findings on this matter. Therefore it is assumed that the newspapers in a positive way created possibilities for public engagement. Furthermore, the representation of research in the newspaper content was quite positive and therefore it is not expected that with regard to this topic the newspapers damaged the credibility of research as a source of knowledge. Nevertheless, some discussions remain. For example, discussions about organic and conventional agriculture, and the effectiveness and moral suitability of governmental interference. Indirect use of research by citizens and politicians suggests that at least to some extent research contributed to public knowledge and perceptions. However, this study focussed on selection and representation of research in Dutch newspapers and therefore does not provide further insight into what people think and talk about in daily life ('agenda-setting', McCombs, 1977). Analysing the prominence of (scientific) research findings in the thoughts of newspaper readers on the matter was not feasible within this thesis project. Nevertheless, it remains an interesting and socially relevant topic to study. This report provides a complete and in-depth starting point for such a study. Another possibility for additional research is the comparison between representations of research in newspaper coverage and in online news sources or television. Furthermore, this study focussed on how research was presented in the media while it was already there. Research on how research-related actors try to receive media attention or 'build the agenda' remains limited (Schäfer, 2010).

Limitations

There are several limitations to this study which should be taken into consideration when interpreting its results. First, the qualitative and issue-specific focus of this study means its results cannot be generalized to other issues, newspapers or geographical areas (Flyvbjerg, 2006). Second, because of the vague and inconsistent reference style found in the newspapers it is possible that not all research sources which contributed to the newspaper were identified. Third, representations of research were not directly compared to the actual research documents or statements. Instead, these representations were compared to information about scientific debates in general, collected in three expert-interviews and a literature review (chapter 2). Although the experts did vary in terms of research focus, experience and background, they are all connected to Wageningen UR. Although the interviews were not expected to provide insight into all individual research types and sources, it is assumed that a comprehensive overview of research topics, debates and sources was reached. The fourth limitation of this study relates to its interpretative design. The issue-frames have been identified by the researcher, which means it cannot be said that these are the only right interpretations. Nevertheless, through use of a codebook, triangulation and cross checking the researcher has sought to provide most plausible interpretations (Creswell, 2014). According to Schäfer (2010) research on science in

the media has been biased in three ways: focussed mainly on natural sciences, Western Countries, and print media. Social sciences seem to be underappreciated, situations in non-Western countries remain underexposed, and upcoming and popular media like television and the internet are neglected. Non-print media like the internet and television are indeed important sources of information for citizens, but were not included in this research. Nevertheless, the Volkskrant and Telegraaf still reach a considerable amount of citizens every day. Moreover, print media remain justifiable sources for media analysis because of their status as opinion leaders and inter-media agenda setters (Schäfer, 2010). Another limitation in this study is its restriction to newspaper articles that were published in print. Nowadays newspapers are often read online. It proved to be unfeasible with regard to time and availability to include online newspaper articles in the data set. As this study is focussed on the Netherlands it does not contribute to the exposure of non-western media content, and it did not aim to do so. This study does not comply with the bias on natural sciences because it focussed on an issue (livestock's contribution to climate change) rather than a certain type of science in particular. Nevertheless, most of the research contributions were indeed focussed on natural sciences. The final but important limitations of this research stem from its focus on newspaper content. The focus on newspaper content means that the production of news (how journalists search for and select research) was not explored. Furthermore, the agenda-setting function of news media has not been tested. Although previous studies and publications suggest that the media indeed can contribute to public knowledge and involvement (McCombs, 1977), it was not studied whether these suggestions apply in this case. It remains unclear whether science and other types of research have contributed to public knowledge and perception with regard to livestock farming as a driver of climate change between 2000 and 2015 in the Netherlands. This brings us back to the implications for further research, discussed in the previous paragraph.

Final note

The importance of research-media interactions should not be underestimated. Especially in the case of climate change research remains an important mediator between environmental processes and the perception of these processes by societal actors. Additionally, research can play an important role in broadening discussions about livestock systems and climate change mitigation options. Knowledge from research might not settle discussions, and it might not be taken up by newspapers completely or accurately. Nevertheless, research can contribute to the quality of newspaper coverage by answering questions, posing questions and challenging assumptions. And in this case it did.

9. Reflection on the Research Process

In this chapter I personally reflect on the research process and how it influenced the research results and content of this report.

At the start of my thesis process I wanted to perform research on communication between farmers and a water board with regard to sustainable agriculture and water management. Although I was in contact with a water board, I could not find a way to take this topic and turn it into a research project. Therefore I searched for a different topic. I found myself stuck in the same situation several times, until the point where I had no choice but to stick with a topic I had chosen. Afterwards I learned that my problem was not so much finding the topic, but the development of the topic at hand. Almost every topic can be developed into interesting research, but it needs to be transformed into a knowledge gap and researchable question. During this bumpy start I wasted quite some time and lost confidence in my research skills, even though my study career before had been unproblematic. Following advice from my supervisor, Margit van Wessel, I took the course Research for Effective Communication. I finished the course successfully, re-established some of my confidence, and regained structure within the research process. Although my research proposal developed sufficiently, I later found that it still lacked focus. During the analysis the need for further specification of my research questions became clear. I reduced the data set to two newspapers and focussed on research, instead of 'knowledge' in general. Looking back I should have specified my research questions more at the beginning of the study, without being afraid to lose valuable data. Applying focus is crucial with regard to feasibility and the depth of the analysis (and in my case, the development of the codebook). Only after the first analysis I managed to focus my research questions and codebook, which meant that some of my work did not pay off in this report. Moreover, only after the specification of my research I could systematically analyse the data. Because of this I had to redo some of my work in order to achieve consistent and credible results. I realise that a further specification of my research questions would still have been possible. First, I could have focussed more on research and less on how the newspapers framed the issue, which now has received quite a prominent role. Furthermore, I could have focussed on consumption, production or governance (instead of livestock production and consumption in general). Then it might have been feasible to explore differences within these frames, and to explore public perception (e.g. focus groups with newspaper readers to find out whether their ideas of the problem correspond to newspapers content and research findings).

Looking back on this reflection I realise that I knew about almost all of these pitfalls and points of attention before I started the thesis process. I had read about them in my study books, and heard about them from teachers and other students. Still I managed to make a lot of mistakes. Fortunately, I also managed to fix these mistakes and to learn from them in the meantime. It has been a process of trial and error. However, I believe that in this process I developed my skills as a researcher to the point that I know how to go about it and feel confident I have the skills to set up, execute, finish and reflect on well-designed research.

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Appendix 1 Emission Sources & Mitigation Options

Emission sources in the livestock sector

Activity	GHG	Source
Feed production	N ₂ O	<ul style="list-style-type: none"> • Application of synthetic N • Application of manure • Direct deposition of manure by grazing and scavenging animals • Crop residue management • N₂O losses related to changes in C stocks • Biomass burning • Biological fixation • Emissions from non-N fertilizers and lime
	CO ₂ N ₂ O CH ₄	<ul style="list-style-type: none"> • Energy use in field operations • Energy use in feed transport and processing • Fertilizer manufacture • Feed blending • Production of non-crop feed (fishmeal, lime and synthetic amino acids) • CH₄ from flooded rice cultivation • Land-use change related to soybean cultivation • Changes in carbon stocks from land use under constant management practices
Non-feed production	CO ₂	<ul style="list-style-type: none"> • Embedded energy related to manufacture of on-farm buildings and equipment • Production of cleaning agents, antibiotics and pharmaceuticals
Livestock production	CH ₄	<ul style="list-style-type: none"> • Enteric fermentation • Manure management
	N ₂ O	<ul style="list-style-type: none"> • Direct and indirect N₂O from manure management
	CO ₂	<ul style="list-style-type: none"> • Direct on-farm energy use for livestock (e.g. cooling, ventilation and heating)
Post farm gate	CO ₂ CH ₄ HFCs	<ul style="list-style-type: none"> • Transport of live animals and products to slaughter and processing plant • Transport of processed products to retail point • Refrigeration during transport and processing • Primary processing of meat into carcasses or meat cuts and eggs • Manufacture of packaging • On-site waste water treatment • Emissions from animal waste or avoided emissions from on-site energy generation from waste • Emissions related to slaughter by-products (e.g. rendering material, hides, skin) • Retail and post-retail energy use • Waste disposal at retail and post-retail stages (like food loss)

Mitigation options in the livestock sector

Activity	GHG	Source
Feed production & grazing	C	<ul style="list-style-type: none"> Conservation of existing C pools in forest vegetation and soil by controlling deforestation protecting forest in reserves, and controlling other anthropogenic disturbances such as fire and pest outbreaks. Reducing slash and burn agriculture, reducing forest fires Improved grass varieties/sward composition, e.g., deep rooting grasses, increased productivity, and nutrient management. Appropriate stocking densities, carrying capacity, fodder banks, and improved grazing management. Appropriate stocking densities, carrying capacity management, fodder banks and improved grazing management, fodder production, and fodder diversification. Improved use of fire for sustainable grassland management. Fire prevention and improved prescribed burning
	N ₂ O	<ul style="list-style-type: none"> Improved N use efficiency, changing N fertilizer application rate, fertilizer type, timing, precision application, inhibitors. Stocking density, animal waste management.
Livestock management	CH ₄	<ul style="list-style-type: none"> Feeding and dietary additives: Improved feed and dietary additives to reduce emissions from enteric fermentation; including improved forage, dietary additives (bioactive compounds, fats) ionophores/antibiotics, propionate enhancers, archaea inhibitors, nitrate and sulphate supplements Breeding and long-term management: Improved breeds with higher productivity (so lower emissions per unit of product) or with reduced emissions from enteric fermentation; microbial technology such as archaeal vaccines, methanotrophs, acetogens, defaunation of the rumen, bacteriophages and probiotics; improved fertility Animal housing system improvements
Manure management	CH ₄	<ul style="list-style-type: none"> Manipulate bedding and storage conditions, anaerobic digesters; biofilters, dietary additives.
	N ₂ O	<ul style="list-style-type: none"> Manipulate livestock diets to reduce N excreta, soil applied and animal fed nitrification inhibitors, urease inhibitors, fertilizer type, rate and timing, manipulate manure application practices, grazing management.
Biomass processing	C	<ul style="list-style-type: none"> Integrating feedstock production with conversion, typically producing animal feed that can reduce demand for cultivated feed such as soy and corn and can also reduce grazing requirements. Using agricultural and forestry residues for energy production.
Post farm gate	CO ₂ CH ₄ HFCs	<ul style="list-style-type: none"> Reduction of transport and energy/fossil fuel use Waste reduction Consumption change

Appendix 2 Codebook

Step 1: Topic Inclusion & Data Selection

Main theme/question: To what extend is the topic referred to in the article?

Code	Code description	Key terms (in Dutch)
Main topic	Livestock farming (or animal consumption) as a driver of climate change is the main topic of the article.	Emissies, broeikasgassen, invloed op klimaat, oorzaak klimaatverandering
Part of article	Livestock farming (or animal consumption) as a driver of climate change is one of the topics referred to in the article.	Emissies, broeikasgassen, invloed op klimaat, oorzaak klimaatverandering
No reference (exclude from analysis)	No reference is made to livestock farming (or animal consumption) as a driver of climate change.	No key terms present

Step 2: Frame Analysis

Main theme/question: Which frame was used to make sense of livestock farming as a driver of climate change?

Code	Code description	Key terms (in Dutch)
Individual consumption and lifestyle	Consumption is described as main cause of problem, consumers can/should influence issue through individual behaviour.	Consumptie, consumenten, lezer direct aangesproken (jij/u), kiezen
Production and supply	Current production methods are described as main cause of problem, change in technology, management or products is main solution.	Techniek, management, productie, boerderij, produceren, innovatie
Governmental interference	The problem is described as part of political and governmental discussion, governmental interference is cause or solution to the problem.	Politiek, overheid, kabinet, regels, heffing

Step 3: Research Analysis

Main theme/question: which sources of research were referred to? And how?

Code	Code description	Key terms (in Dutch)
Research direct	A direct reference is made to research or research results by the author of the article. Characteristics of research from theoretical framework as main research identifiers.	Onderzoek, onderzocht, wetenschap, ontdekken/ontdekt, studie
Research indirect	An indirect reference was made to research or research results by interviewee, reader, or referenced person or document.	Volgens.., onderzoek, onderzocht, wetenschap(pers)
Researcher(s) direct	A direct reference was made to researchers or research institutes by the author of the article. Characteristics of research from theoretical framework as main research identifiers.	Onderzoeker(s), wetenschapper(s), Dr./Prof., universiteit, onderzoeksinstituut
Researcher(s) indirect	An indirect reference was made to researchers or research institutes by interviewee, reader, or referenced person or document.	Volgens.., onderzoek, onderzocht, wetenschap(pers)

Appendix 3 Research References

The following sources were referred to by the Volkskrant and Telegraaf. These source descriptions mirror the way they were referred to by the newspapers. The numbers of these references correspond to the source numbers in chapter 6. When sources were referred to indirectly by other speakers this is indicated.

Volkskrant

Research projects and documents VOLKSKRANT	Direct/indirect reference
1. ABN Amro bank: research on the sustainability/emissions of animal products (explosion chicken)	Direct
2. Athol Klieve (Australia): report from 2002 about possibilities to reduce methane release during enteric fermentation by transporting bacteria from kangaroos into cows	Direct
3. Blonk Environmental Advice organisation in general	Direct & indirect
4. Blonk Environmental Advice: research report 'Environmental Effects of the Dutch Consumption of Protein Rich products' (2008) assigned by the Ministry of Infrastructure and Environment (VROM)	Direct & indirect
5. Calculation performed by 'a scientist' about the climate impact of meat-eating cats and dogs compared to cars	Direct
6. Carnegie Mellon University Pittsburgh: calculation from 2008, how much emissions released during animal production compared to transport of animal products etc.	Direct
7. CE Delft: environmental analysis of Valess meat replacement product	Direct
8. Cor van der Weele, researcher: publication of 'In-vitrovlees: Yuck!(!?)', exploration of public acceptance in-vitro meat	Direct
9. David Tilman and Michael Clark, ecologists from the University of Minnesota: publication in Nature of a meta-analysis on environmental and health effects of different diets	Direct
10. Dennis Oonincx: article about greenhouse gas emissions of insects, published in PLoS ONE	Direct
11. Milieu Centraal consumer information organisation (Environment Central Foundation): calculation emissions food consumption	Direct
12. Food and Agriculture Organisation of the United Nations (FAO) in general	Direct & indirect
13. Food and Agriculture Organisation of the United Nations (FAO): 'Livestock's Long Shadow report' (2006) with Henning Steinfeld as first author	Direct & indirect
14. Food Monitor: research on public acceptance of meat replacement products	Direct
15. French experiment in which goats are bred without particular bacteria in their stomach which causes methane emissions	Indirect
16. Geographical Research Letters: the latest number (2003) about current methane concentrations in the atmosphere	Direct
17. Hanna Tuomisto from the University of Oxford: evaluation of the sustainability of in-vitro meat	Direct
18. ING Wholesale business bank: report on the influence of climate change on stock markets regarding food- and beverage companies	Direct
19. Intergovernmental Panel on Climate Change (IPCC): fifth climate report (2014)	Direct

20. Jonathan Foley, director of the Institute for Environmental Questions of the University of Minnesota ("gathered a team of researchers"): report on the possibilities to feed the world population in the future, publication in Scientific American in 2011 and in the National Geographic in 2014	Direct
21. LEI Research Institute: calculation feasibility organic production in the Netherlands and potential additional costs	Indirect
22. Lincoln University Christchurch: calculation from 2006 about climate impact agricultural products New Zealand compared to European products	Direct
23. Lucas Reijnders, professor from the University of Amsterdam: publication in the American Journal of Clinical Nutrition about climate impact of different products	Direct
24. Mark van der Veen: study on consumer behaviour at sixteen Dutch companies	Indirect
25. Milieu Centraal (Environment Central Foundation), an independent organisation which provides consumer advice about the environment and energy in our daily lives. The foundation used numbers from Blonk Consultants, CE Delft and Milieu Centraal.	Direct
26. National Centre for Atmospheric Research (Boulder, USA) and Texas A&M University: publication in science of October 9, 2003 about causes drought Sahel not caused by human-induced climate change but warmed ocean water	Direct
27. Newspaper research: 'Spul' (Stuff) and 'Proef' (Taste) columns	Direct
28. Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency): 'Milieu- en Natuurbalans 2009' (Environment- and Nature Balance), partly based on research results from Blonk Environmental Advice	Direct
29. Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency): 'De Nationale Milieuverkenning 2006-2040' (the National Milieu Exploration)	Direct
30. Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency) in corporation with Energieonderzoek Centrum Nederland (the Dutch Energy Research Centre): future scenarios of Dutch sustainability and emissions	Direct
31. Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency): 'Duurzaamheidsverkenning 2007' (Sustainability Exploration)	Direct
32. Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency): report 'The Protein Puzzle report'	Direct
33. 'Profetas' (Protein Foods, Environment, Technology and Society): project led by professor Harry Aiking from the VU University of Amsterdam, final report (2005)	Direct
34. Rik van Dijk, researcher from the University of Amsterdam: recently published report (2011): 'Kweekvleesontwikkeling in Nederland: topsector in wording of gemiste kans?' (In-vitro meat development in the Netherlands: top sector to be or missed opportunity?)	Direct
35. Sanderine Nonhebel, college professor at the centre of energy and environmental studies at the State University Groningen: calculation on the possibility and sustainability of feeding all Dutch pigs with food waste	Direct
36. Sirpa Kurpa, Helmi Risku and Juha Helenius, Finish scientists: publication in Journal Progress in Industrial Ecology about emissions from soil management vs. livestock breeding	Direct
37. Sociaal en Cultureel Planbureau (Institute for Social Research), Sociaal Planbureau (Bureau for Economic Policy Analysis), Centraal Bureau voor de Statistiek (Statistics	Direct

Netherlands): 'Monitor Duurzaam Nederland 2009' (Monitor Sustainable Netherlands)	
38. Stichting Natuur en Milieu (Nature and Environment Foundation) and chef Pierre Wind: the results of a study on sustainability and flavour of sausages	Direct
39. United Nations organisation in general	Direct & indirect
40. Varkens in Nood (Pigs in Distress) and Milieu Defensie (Environmental Defence): 'Vleeswijzer' and 'Superwijzer' (product sustainability information tools) based on results from Blonk Environmental Advice and research on animal welfare performed by ethicist Francien de Jonge	Direct & indirect
41. Vegetariërsbond (Vegetarian's Union): calculation about the amount of meat consumed by Dutch citizens during the Christmas Holidays (used numbers from Blonk Environmental Advice and Productschap Vlees, Melk en Eieren (Product Organisation or meat, dairy and eggs))	Direct
42. VU University Amsterdam: calculation on emissions from meat consumption compared to cars (potential emission reduction reduced traffic vs. reduced meat consumption)	Indirect
43. VU University: research on about how much money is paid for products not by the consumer but society as a whole	Indirect
44. Wageningen University and Research Centre: an explorative research on health aspects of milk from cows who live in paddocks or stay in stables	Direct
45. Wageningen University project on feed additives (e.g. garlic) to reduce methane from enteric fermentation	Direct

Individual researchers VOLKSKRANT	Direct/indirect reference
46. Rene Aerts, research director at animal medicine company Intervet	Direct
47. Harry Aiking, retiring toxicologist at the VU Amsterdam University and author of the in 2006 published book Sustainable protein production and consumption: pigs or peas? (direct & indirect)	Direct & indirect
48. Hans Baaij from Varkens in Nood (Pigs in Distress), initiator of Vleeswijzer (meat information tool)	Direct
49. Geert Bergsma, researcher at CLM Delft, the research agency which provided the information for the 'Superwijzer' (product information tool)	Direct
50. Martijn Blom and Maartje Seventer, researchers at CE Delft	Direct
51. Hans Blonk, researcher as Blonk Environmental Advice	Direct
52. Imke de Boer, professor Animal Production Systems at Wageningen University	Direct
53. Remko Boom, the first professor of meat replacement products, works at Wageningen University	Direct
54. Marc Davidson, environmental ethicist at the University of Amsterdam	Direct
55. Marcel Dicke, professor of Entomology at the University of Wageningen	Direct
56. Daan van Doorn who studied the future of livestock farming	Indirect
57. Aalt Dijkhuizen, (former) head of Wageningen UR	Indirect
58. Louise Fresco, food expert	Direct & indirect
59. Maarten Hajer, director of the Planbureau voor de Leefomgeving (Netherlands	Direct

Environmental Assessment Agency)	
60. Rene Houkema from Varkens in Nood (Pigs in Distress) about calculation emissions chicken	Direct
61. Arnold van Huis, tropical entomologist and professor at Wageningen University and Research Center	Direct
62. Francien Jonge, studied animal welfare for the Vleeswijzer (meat information tool)	Direct
63. Tim Lang, professor of food policy at City university and co-author of The Atlas of Food	Direct & indirect
64. Niko Koffeman, president of the scientific bureau for the Partij voor de Dieren (Party for the Animals)	Direct
65. Jos Olivier, Dr. researcher at who keeps track of methane emissions for the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency) & Rijksinstituut voor Volksgezondheid en Milieu (National Institute for Public Health and the Environment)	Direct
66. Rajendra Pachauri, president of the Intergovernmental Panel on Climate Change	Direct
67. Michael Pollan, Knight professor of science and environmental journalism and teacher at the University of California, author of The Omnivore's Dilemma and Defense of Food	Direct
68. Donald Pols, researcher at Energie Centrum Nederland (Dutch Energy Centre)	Direct
69. Mark Post, researcher on in-vitro meat, used to be cardio-vascular doctor	Direct
70. John Powles from Cambridge University	Indirect
71. Rudy Rabbinge, professor sustainable development at Wageningen University	Direct
72. Lucas Reijnders, professor from the university of Amsterdam and author of publication in the American Journal of Clinical Nutrition about climate impact of different products	Direct
73. Matt Ridley, British writer and scientist	Direct
74. Gerard Rijk, analyst and researcher involved in ING Wholesale research	Direct
75. Bill Rudimann from the University of Virginia	Indirect
76. Gert Spaargaren, professor of Environmental Policy/Environmental behaviour and sociologist at Wageningen University	Direct
77. Spokesperson DSM research company, says DSM is working on feed additives to reduce methane release during enteric fermentation	Direct
78. Henning Steinfeld, first author of Livestock's Long Shadow: statements in New Scientist	Direct
79. Pavan Sukhdev, economist from the Deutsche Bank calculation	Indirect
80. Richard Tol, professor	Indirect
81. Theun Vellinga, dairy researcher at Wageningen UR	Direct
82. Wilfred Vermeris, professor micro biology at the University of Florida	Direct
83. Wouter van der Weijden, researcher at CLM	Direct
84. Henk Westbroek, researcher from the Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency)	Direct
85. Annemarie van Wezel (Dr.), researcher involved in the report 'Nationale Milieuverkenning 2006-2040' (National Environmental Exploration)	Direct

86. George Wilson, philosopher and livestock expert and founder of the Australian Wildlife Services, advice agency for nature and environment	Direct
87. Sander van Zijderveld, working on a thesis about feed additives at Provimi feed company	Direct
88. Hink Perdok, research director at Provimi animal feed company	Direct
89. William (Bill) Laurance, professor and chair of the Prince Bernard chair group for international environmental protection. Originally American tropical forest entomologist.	Direct

Telegraaf

Research projects and documents TELEGRAAF	Direct/indirect reference
1. Aquarius Alliance, a collaboration between farmers and scientists, criticism on manure policy	Direct
2. Blonk Environmental Advice: research assigned by ministers Verburg and Cramer (direct & indirect)	Direct & indirect
3. DSR research agency: research report 'Investing in climate change: the role of Dutch banks' (indirect)	Indirect
4. Food and Agriculture Organization of the United Nations in general	Direct & indirect
5. Food and Agriculture Organization of the United Nations: Livestock's Long Shadow report (2006)	Direct
6. Frédéric Chomé (French environmental consultant), Annika Carlsson-Kanyama (Sweden), Riita Rätty (Finland): a combination of two European studies: emissions men vs. women	Direct
7. Het Instituut voor Milieuvraagstukken (the Institute for Environmental Questions): calculation of emissions from cars and meat	Direct
8. Klaas Jan Kramer: promotion research at the State University Groningen (December 1, 2000) on the essay 'Food Matters'	Direct
9. Max Planck Institute (Heidelberg, Germany): publication in Nature, results from a study on methane production of plants	Direct
10. National Institute for Public Health and the Environment (RIVM): tables about soil quality (indirect)	Indirect
11. Newspaper research: 'Stelling van de dag' (statement of the day) / 'WATUZEGT' (What you say)	Direct
12. Ruigrok/NetPanel: large scale study on the environmental consciousness of Dutch citizens initiated by the Hier foundation (a collaboration of more than 40 nongovernmental organizations in the Netherlands)	Direct
13. SenterNovem: study amongst climate professionals as part of the 'Reductie Overige Broeikasgassen' program (Reduction Other Greenhouse Gases) commissioned by the ministry of Infrastructure and the Environment (VROM)	Direct
14. Tomsk State University and the British University of Oxford: publication in New Scientist about results from a collaborative research on melting permafrost	Direct

15. University of Maastricht: research team presentation of the in-vitro burger	Direct
16. University of Stuttgart: the development of an anti-flatulence pill	Direct
17. Varkens in Nood (Pigs in Distress) and Milieu Defensie (Environmental Defence): Vleeswijzer/Superwijzer (product sustainability information tools)	Direct & indirect
18. Wageningen University: results from research on the effects of garlic on methane production in enteric fermentation	Direct
19. Wageningen UR: 'Klimaat en Veehouderij' report (Climate and Livestock Farming), in response to 'Meat the Truth' documentary	Direct
20. Wageningen University: project on animal feed additives	Direct
21. The agricultural university of Wageningen (in corporation with Aquarius Alliance, Stichting Milieubewuste Veehouderij (Foundation Sustainable Livestock Sector), and the advice agency Team Ecosys) about manure policy	Direct

Individual researchers TELEGRAAF	Direct/indirect reference
22. Sergery Brin, one of the men behind internet giant Google and financier of in-vitro meat project	Direct
23. Marcel Dicke, professor entomology at the Wageningen University and co-author of a cookbook about insects (together with Arnold van Huis)	Direct
24. Aalt Dijkhuizen, (former) head of Wageningen University and Research Centre	Direct
25. Jan Dijkstra (Dr. ir.), teacher animal feed at the Animal Science Group of Wageningen University	Direct
26. Willem van Eelen, (86 years old) started technological scientific research on in-vitro meat	Direct & indirect
27. Louise Fresco, Agricultural expert	Indirect
28. Arnold van Huis (Prof. dr. ir.), entomologist at the Wageningen University and co-author of a cookbook about insects (together with Marcel Dicke)	Direct
29. Mark Post, in-vitro meat researcher	Direct
30. Rudy Rabbinge, professor at Wageningen University	Direct
31. Bernard Roelen (Dr.), Cell Biologist from the University of Utrecht	Direct
32. Thomas Roeckmann, professor chemistry of the atmosphere at the University of Utrecht and research leader at Max Planck Institute	Direct
33. Frits van der Schans, team leader at research agency CLM (Culenburg)	Direct

Appendix 4 Interview Interpretations in Dutch

Interview dr.ing. René Schils

1. *Wat zijn/waren belangrijke onderzoeken en inzichten met betrekking tot de rol van veehouderij in klimaatverandering?* Volgens de respondent is vanaf 1990-1995 belangstelling ontstaan voor broeikasgasemissies uit de veehouderijsector. Meetreeksen zijn toen begonnen, onder andere met betrekking tot emissies van lachgas uit het toedienen van kunstmest en drijfmest, methaanemissies van met name herkauwers, en co₂ uit veranderend landgebruik. Naast metingen en life cycle assessments zijn er mitigatiemaatregelen ontworpen, zoals een veranderde veevoersamenstelling (methaanreductie) en verlaging van kunstmestgebruik op graslanden en andere gewassen (lachgasreductie). Het is belangrijk om niet alleen te kijken naar de gevolgen van maatregelen voor het milieu en de reductie van emissies, maar ook naar de invloed van deze maatregelen op de productiviteit en eventuele inkomsten van het bedrijf, en de afwenteling op andere emissies (zoals bijvoorbeeld bij ondergrondse injectie van mest). Volgens de respondent is de communicatie naar het bredere publiek (misschien) in de jaren na 2000 gegroeid (noemt hierbij Partij voor de Dieren en Livestock's Long Shadow).

2. *Wie zijn/waren belangrijke instituten en/of auteurs met betrekking tot de rol van veehouderij in klimaatverandering?* De respondent noemt de FAO en beschrijft dit als een organisatie met een reputatie en zeker vertrouwen. Hij staat meer wantrouwend tegenover de documentaire Meat the Truth van de Partij voor de Dieren. Ook noemt de respondent de vakgroep Animal Production Systems met Imke de Boer, een groep die life cycle assessments heeft gedaan en publicaties heeft gedaan die de conclusies uit Livestock's Long Shadow voor een deel versterken. De IPCC en FAO opereren op een groot niveau en hebben een grote impact op de discussie, maar tegen de IPCC wordt ook 'aangeschopt door critici'. Alterra heeft op het gebied van lachgasemissies een vrij grote rol gespeeld, met name bij het meten van emissies en het ontwerpen van mitigatiemaatregelen. Ook noemt de respondent het onderzoeksprogramma Reductie Overige Broeikasgassen (ROB), waarin Alterra een behoorlijke rol heeft gespeeld. Methaanemissies koppelt de respondent meer aan Livestock Research, lachgas en koolstofdioxide emissies uit bodem- en landgebruik meer aan Alterra. Plant Research International heeft ook wel wat gedaan met emissies, maar vrij weinig. Het Energiecentrum Nederland (ECN) heeft ook wel gemeten maar nooit een dominante rol gespeeld. Hun bijdrage lag vooral op het vlak van innovatieve meetmethoden. En er is technologisch instituut dat in het verleden IMAG heette, nu Food & Biobased Research, dat onder andere de emissies van mestopslagen heeft gemeten. De respondent geeft aan dat er in het buitenland ook veel partijen met het onderwerp bezig zijn en noemt Pete Smith in Edinburgh die zich richt op bodemkoolstof, en Jean-Francois Soussana van INRA uit Frankrijk. De respondent maakt onderscheid tussen verschillende soorten onderzoek waaronder Wageningen UR, Alterra, Livestock Research, INRA, en financiers van onderzoek zoals het programma Reductie Overige Broeikasgassen (wat in feite geldt is van de Nederlandse overheid) en Europese directoraten zoals DG Climate en DG Environment die met name binnen de klimaatdiscussie onderzoek aanzwengelen. Ook noemt de respondent de 'Global Research

Alliance on Greenhouse Gases', dat 4-5 jaar geleden met name vanuit Nieuw-Zeeland is geïnitieerd. Daarin worden onderzoekers en instituten uit verschillende landen bij elkaar gebracht, gestimuleerd en deels gefinancierd om samen onderzoek te doen. In landen als Nieuw-Zeeland is het aandeel van de landbouw qua emissies hoog, vandaar dat die landen veel belang hebben bij mitigatiemaatregelen in deze sector. De respondent vindt het lastig om iets over Blonk Milieuadvies te zeggen omdat hij dit bureau 'niet zo goed' kent. Over belangengroepen als de Nederlandse Melkveehouders Vakbond zegt de respondent dat zij ook her en der proberen onderzoek uit te zetten en het debat proberen te beïnvloeden, en hierbij soms 'hele andere rekensommen maken'. Hierbij geeft hij aan dat het belangrijk is om te kijken naar wie de opdrachtgever is van onderzoek. De respondent vindt het goed dat er in zekere zin ook concurrentie is in de onderzoekswereld om elkaar scherp te houden, ook omdat in Nederland Wageningen een erg dominante rol speelt. Ook benadrukt hij aan dat alhoewel Wageningen als een geheel wordt gezien, er ook voor verschillende opdrachtgevers wordt gewerkt (waaronder de overheid en bedrijven). Hier moet dus ook gekeken worden naar wie de opdrachtgever van het onderzoek is en wie er voor betaalt. Er bestaat volgens de respondent in de wetenschappelijke wereld onder andere discussie over meetmethoden (hoe broeikasgassen/emissies gemeten en berekend moeten worden), en koolstofvastlegging in de bodem (wat het lange termijn effect hiervan is).

3. Welke inzichten en/of onderzoeksresultaten zijn relevant voor burgers en lezers van de krant?

Volgens de respondent is het relevant om te communiceren richting burgers over de bijdrage van landbouw en veehouderij aan de broeikasgasemissies, en de invloed die mensen door middel van hun consumptie en (voedsel)verspilling hier op uitoefenen. Het draait hierbij onder anderen om bewustwording. Hoewel sommige burgers geïnteresseerd zijn in wetenschappelijke inzichten denkt de respondent dat dit een hele beperkte groep is. De respondent kan zich nog herinneren dat er in de media aandacht is geweest voor het onderwerp en noemt hierbij een uitspraak van Marianne Thieme, dat je beter een vegetarier kunt zijn die in een hummer rijdt dan een vleeseter in een Toyota Prius. Hoewel mensen het hier wel of niet mee eens kunnen zijn zet de uitspraak het debat volgens de respondent wel scherp neer. Ook herinnert hij zich een veelgemaakte fout over methaanscheten, terwijl koeien vooral methaan opboeren. Hoewel hij zich daar wel eens aan stoort is dat volgens de respondent verder niet belangrijk voor het debat en geeft hij aan dat dit leuker klinkt in de pers. Ook noemt deze respondent de namen van enkele journalisten die over het onderwerp hebben geschreven: Karel Knip van het NRC en Marcel Crok (die laatste schreef meer over klimaatverandering). Volgens de respondent wordt door de wetenschapsredacties van NRC en Volkskrant over het algemeen vaak vrij gedegen over het onderwerp geschreven. Dat aan de universiteit verbonden personen als Aalt Dijkhuizen en Louise Fresco uitspraken doen in de krant vindt de respondent goed. Deze uitspraken moeten wel enige nuance bevatten, wat bij sommige uitspraken in het verleden iets meer had gemogen. Ook is Wageningen UR een grote organisatie met een pluriformiteit aan meningen, die ook door deze mensen naar buiten gebracht moet worden (in plaats van een persoonlijke mening). Zeer gespecialiseerde meningen vindt hij meer iets voor hoogleraren en andere wetenschappers die zich echt met het onderwerp bezig houden.

4. Wat is de mening van de respondent over verschillende discussiepunten en onduidelijkheden uit de media?

De potentiële bijdrage van verminderde vleesconsumptie: de respondent vertelt dat vleesconsumptie bijdraagt aan broeikasemissies en denkt dat er op zich weinig discussie is over de volgorde van emissies van rundvlees, melk, witvlees en pluimvee. Volgens de respondent is er wel discussie over hoe zwaar bijvoorbeeld dierenwelzijn en broeikasgassen ten opzichte van elkaar moeten worden gewogen. Daarnaast hangt de broeikasgassen per kg energie of eiwit van vleesvervangers erg af van de bewerkingsstappen. Voor zover de respondent weet zijn sommige vleesvervangers slechter dan sommige dierlijke producten, maar minder slecht dan de slechtste dierlijke producten. Hoewel de respondent denkt dat minder consumptie in het algemeen beter zou zijn vraagt hij zich af of wij ontwikkelende landen als China, Azië en delen van Afrika moeten en kunnen voorschrijven minder vlees te eten. Volgens hem wordt de toename in vleesconsumptie bij inkomensstijging gezien als een soort automatisch proces, en noemt dit een ethisch vraagstuk.

Biologisch of conventioneel, industrialisatie of kleinschalig? Volgens de respondent bestaat het beeld dat biologisch beter is, terwijl in de wetenschap gezien wordt dat biologische veehouderij qua emissies per kg product niet beter “of soms zelfs slechter” is (dat er meer uitstoot is). Daar is in de wetenschap wel consensus over.

Lokaal of mondiaal? Ook heeft de respondent het idee dat er in algemene zin een beeld bestaat dat wat van ver af slechter is dan wat je van dichtbij haalt. Hij geeft aan dat dit echter heel genuanceerd ligt. Hij legt uit dat de meeste broeikasgassen per kilogram product ontstaan bij de primaire productie, meer dan bij transport. Ook spelen andere dingen een rol, zoals arbeid en het loon van arbeiders.

Zijn koeien ‘efficiënte eiwit-omzetters’ of niet? De respondent legt uit dat koeien niet erg efficiënt zijn wanneer er bijvoorbeeld wordt gekeken naar de stikstofinput via voer vs. de melk output. Daarbij vertelt de respondent dat koeien wel efficiënt zijn in het benutten van energie uit planten die voor mensen onverteerbaar zijn. Dit laatste geeft reden om toch een stukje rundveehouderij te hebben, maar dat dat dan eigenlijk alleen plaats zou moeten vinden waar geen graan voor mensen geteeld zou kunnen worden. De huidige situatie is dat in de varkenshouderij en pluimveehouderij ook graan wordt geteeld voor vleesproductie. Dit noemt de respondent vrij inefficiënt, en dat dit bij wijze van spreken beter direct aan mensen gevoerd kan worden.

Veehouderij draagt voor 18% bij aan emissies van broeikasgassen, bijdrage is groter dan verkeer? Is de Nederlandse situatie anders? De respondent legt uit dat er in de wetenschap niet één vast getal is, maar dat dit afhangt van wat er allemaal wel- en niet meegerekend wordt. Hij denkt niet dat hier veel discussie over is. Er zijn landen waar de landbouw en met name veehouderij veel bijdraagt, en andere landen waar de veehouderij minder bijdraagt. Hierbij vergelijkt hij de Nederlandse situatie (minder dan 18%) met andere landen (“Afrika en dergelijken”) waar het veel meer bijdraagt. De respondent geeft hij aan dat het prettig is als mensen überhaupt weten dat landbouw bijdraagt aan broeikasgasemissies, en dat hij zich afvraagt of het voor het grote publiek echt boeiend is of dit nou 10 of 13 of 15% is.

Interview dr.ir. Theun Vellinga

1. Wat zijn/waren belangrijke onderzoeken en inzichten met betrekking tot de rol van veehouderij in klimaatverandering? Volgens de respondent kwam op de grens van de jaren 1999-2000 meer aandacht voor de bijdrage van veehouderij aan het klimaatprobleem. In deze tijd was de respondent ook zelf betrokken bij onderzoek naar lachgas bij de teelt van klaver, scheuren van grasland, beweiding etc. In samenwerking met Alterra zijn toen onder andere literatuurstudies uitgevoerd. Ook noemt de respondent metingen van verschillende broeikasgassen, en modelleren. De respondent geeft aan dat constateren van het probleem één ding is, maar het aandragen van manieren om hier mee om te gaan een tweede. Ook benadrukt de respondent de invloed van het rapport *Livestock's Long Shadow* van de Voedsel- en Landbouworganisatie (FAO). Dit rapport heeft volgens de respondent het probleem internationaal op de agenda gezet en de discussie aangezwengeld. Hij vertelt dat hierbij de eerste grote berekening werd gedaan waarbij alle onderdelen van veehouderij werden meegerekend, anders dan bij berekeningen van het Intergovernmental Panel on Climate Change. De respondent legt ten slotte uit dat er naast klimaatverandering ook veel andere interessante informatie in dit rapport te vinden is, maar dat toch opvallend veel aandacht is gegaan naar het onderdeel over emissies.

2. Wie zijn/waren belangrijke instituten en/of auteurs met betrekking tot de rol van veehouderij in klimaatverandering volgens de respondent? Ten eerste geeft de respondent aan dat bijna alle op veehouderij gerichte groepen zich wel bezig houden met broeikasgassen. Ook hier noemt de respondent de FAO, zelf geen onderzoeksinstituut maar wel een belangrijke speler op dit gebied. Hij legt uit dat deze organisatie een belangrijke rol speelt in de ontwikkeling van een visie op wat er aan het probleem gedaan kan worden, en verschillende wetenschappelijke instellingen/onderzoekers bij elkaar brengt. Ook noemt de respondent Alterra, waarbij het onderzoek niet zozeer gericht is op livestock, maar wel op emissies van onderdelen die er bij horen als alle onderdelen van het veehouderijbedrijf worden meegerekend. Ook noemt hij *Livestock Research* van Wageningen UR. Ook is Nieuw Zeeland een belangrijke partij in onderzoek en ontwikkeling op dit gebied volgens de respondent, en hij noemt hierbij de rol van Nieuw Zeeland in de *Global Research Alliance*, waaronder de *Livestock Research Group*. Martin Scholten (van *Animal Sciences group*, Wageningen UR) en Harry Clark (*New Zealand Agricultural Greenhouse Gas Research*) worden hierbij genoemd, en de respondent vertelt dat er een bijeenkomst is in Italië ten tijde van dit interview. De respondent heeft ervaring met *Blonk Milieuadvies* als samenwerkingspartner en geeft aan dat dit onderzoeksbureau zorgt voor goede studies en dat Hans Blonk open staat voor debat. CLM lijkt volgens de respondent soms meer te handelen volgens een vooropgezette agenda, en hij verwijst hierbij naar een rapport van deze organisatie over varkensvleesproductie, waarbij het lijkt alsof er keuzes werden gemaakt om een bepaald systeem beter te laten lijken. De film *Meat the Truth* beschouwt de respondent 'allerminst' als wetenschappelijk. Hierbij geeft hij aan het goed te vinden dat een dergelijke partij deelneemt aan het debat, maar dat dit niet moet gebeuren met een air dat het wetenschappelijk is. Verder geeft de respondent aan dat het goed is om met verschillende studies aspecten van het probleem te belichten, en dat verschillende instituten ook veel gebruik maken van elkaars kennis (onder anderen voor

berekeningen). Peer review is volgens de respondent niet altijd een garantie voor kwalitatief goede studies, en de afdeling van de respondent zelf publiceert ook rapporten zonder peer review. Tenslotte is het belangrijk dat onderzoekers objectief zijn en niet informatie zoeken om een van tevoren besloten boodschap te onderbouwen.

3. Welke inzichten en/of onderzoeksresultaten zijn relevant voor burgers en lezers van de krant? De respondent geeft aan het belangrijk te vinden dat er onderscheidt wordt gemaakt tussen veehouderij in Nederland en veehouderij in andere delen van de wereld, zoals Afrika en Azië. Ten eerste omdat de belangrijkste ontwikkelingen in die laatstgenoemde landen plaatsvinden. Maar ook omdat een toename van de vleesconsumptie in die ontwikkelende landen logisch, terecht en mogelijk positief is. Hierbij spreekt de respondent over sustainable intensification en legt hij uit dat voedselzekerheid en vermindering van broeikasgassen niet altijd tegengesteld zijn maar in grote delen van de wereld juist hand-in-hand gaan. In Europa is voedselzekerheid veel minder een issue en daardoor spelen andere aspecten zoals dierenwelzijn en milieu hier een grotere rol. Ook is er niets op tegen in de Westerse wereld minder vlees te gaan eten, halveren is een optie en kan een positief effect hebben op de gezondheid. Ook wijst de respondent op de verdeling van dieren aantallen, en legt hierbij uit dat 50% van de varkens in China wordt gehouden, en dat in een land als India meer runderen zijn dan in de gehele Europese Unie, en dat dit dus in perspectief moet worden geplaatst. Naast aandacht voor internationale verschillen wijst de respondent op het bestaan van een vertekend 'romantisch en nostalgisch' beeld van de landbouw, waarbij het soms lijkt dat de landbouw zich niet mag ontwikkelen. Ook herinnert de respondent zich één genuanceerd artikel in de Volkskrant over een Nederlands melkveehouderijbedrijf, en geeft aan dat er te weinig geschreven wordt vanuit de agrarische sector zelf, of op basis van veel kennis van de sector. Dat mensen als Louise Fresco, Aalt Dijkhuizen en Henning Steinfeld zich uitspreken in de media vindt de respondent goed omdat zij de kenniskant vertegenwoordigen en omdat het belangrijk is te discussiëren op basis van feiten en niet enkel onderbuik gevoelens. Wel moeten dergelijke uitspraken volgens de respondent met beleid en nuance gedaan worden.

4. Wat is de mening van de respondent over verschillende discussiepunten en onduidelijkheden uit de media?

De potentiële bijdrage van verminderde vleesconsumptie: een vermindering van de vleesconsumptie is volgens de respondent in het Westen mogelijk positief, maar in sommige andere delen van de wereld niet. Ook bestaan er volgens de respondent tegenstanders van de veehouderij die willen dat iedereen vegetariër en die alles aangrijpen om hun standpunt te onderbouwen. De respondent geeft hierbij de film *Meat the Truth* van de Partij voor de Dieren als voorbeeld. Het is volgens de respondent "een kwestie van minder en efficiënter". Ook zegt de respondent uit dat er steeds meer mensen komen, "en mensen moeten eten".

Biologisch of conventioneel: de respondent geeft aan dat er mensen zijn die er helemaal voor biologisch zijn, en dat er mensen zijn die compleet achter intensivering staan. Hierbij geeft hij aan dat zijn voorkeur niet uitgaat naar kleinschalige biologische productie omdat efficiëntie en ontwikkeling

belangrijk zijn voor de productiviteit, arbeidsomstandigheden en verhouding van input en output en dus duurzaamheid. Hierbij geeft hij ook aan dat er een grens zit aan technische optimalisatie en dat efficiëntie niet ten koste van alles mag gaan. Hoewel in Nederland de grens van technologische optimalisatie ver is bereikt is er volgens de respondent in andere delen van de wereld nog veel winst te boeken.

Lokaal of mondiaal: als lokale productie meerwaarde oplevert bijvoorbeeld wanneer burgers leren hoe iets geproduceerd wordt is dit volgens de respondent goed. Het is volgens hem echter onmogelijk op lokaal niveau alles te produceren, onder anderen omdat op wereldniveau een groot deel van de populatie in agglomeraties woont. In plaats daarvan is het slim te produceren daar waar het efficiëntst is, hierover verwijst de respondent ook naar een onderzoek dat is uitgevoerd. Ook zouden meststoffen wereldwijd getransporteerd moeten kunnen worden.

Is een koe efficiënte eiwit-omzetter? Volgens de respondent levert de keuze tussen verschillende dieren op basis van duurzaamheid dilemma's op. Een koe kan bijvoorbeeld voor de mens onverteerbare producten (stro, gras, bijproducten uit industrie) omzetten naar humane voeding, maar stoot ook veel methaan uit. Kippen stoten minder broeikasgassen uit en zijn wellicht ook gezonder, maar door hun voeding concurreren zij ook met humane voeding. De respondent vindt het goed dat er lijstjes gemaakt worden qua duurzaamheid van producten maar vindt het een lastige kwestie omdat mensen een eenduidig antwoord willen wat ze moeten doen en er niet altijd een simpel antwoord is. Een voorbeeld dat de respondent geeft gaat over de voor- en nadelen van weidegang.

Hoe groot is de bijdrage van veehouderij aan het klimaatprobleem? En hoe zit het met de Nederlandse situatie? Volgens de respondent zijn berekeningen als die van de FAO 18% altijd omgeven door onnauwkeurigheid omdat er sprake is van berekeningen waarvoor niet altijd genoeg gegevens beschikbaar zijn. Van een iets ander cijfer wordt het verhaal niet anders, maar binnen die onnauwkeurigheid moet de berekening wel kloppen, aldus de respondent. Hij geeft een voorbeeld van Amerikanen die uitkwamen op 51%, en waartegen toen een publicatie is in geschreven.

Interview PhD Candidate and Teacher Dennis Snoek

1. Wat zijn/waren belangrijke onderzoeken en inzichten met betrekking tot de rol van veehouderij in klimaatverandering?

De respondent geeft aan dat in de jaren 90 onderzoek is gedaan naar de emissies van ammoniak, en heeft het idee dat dergelijke onderzoeken ook naar methaan- en co2 emissies hebben plaatsgevonden. Ook noemt de respondent onderzoek naar de effectiviteit en duurzaamheid van bepaalde mitigatiemogelijkheden zoals stalvloeren, dakisolatie, luchtwassers en methoden om (drijf)mest uit te rijden. Hij legt uit dat er in het verleden beleid is gemaakt op basis van wetenschappelijke inzichten, en dat nieuw onderzoek dergelijke keuzes soms in twijfel trekt. Er wordt gekeken of mitigatiemaatregelen ook echt werken. Daarnaast is er volgens de respondent wetenschappelijke discussie over bepaalde berekeningen en modellen (of deze kloppen of niet).

Verder geeft de respondent aan dat er veel factoren zijn die invloed hebben op het klimaat waardoor het lastig is dit te bestuderen en aan te geven welke conclusies juist zijn. Ook is onderzoek een doorlopend proces dat steeds nieuwe vragen oproept. Tenslotte geeft de respondent aan dat er

spraken is van verschillende specialisaties en terminologieën (wiskundige berekeningen, modellen, systemen) en dat het belangrijk is termen te verduidelijken en kennis te integreren.

2. Wie zijn/waren belangrijke instituten en/of auteurs met betrekking tot de rol van veehouderij in klimaatverandering? De respondent legt uit dat er een technische adviescommissie voor de overheid bestaat die gericht is op veehouderijsystemen, en dat kennis experts uit het vakgebied, overheidsmensen, en mensen van de universiteit hierbij betrokken zijn. Ook noemt hij werkgroepen, vaak samenwerkingsverbanden tussen RIVM, Wageningen UR en TNO, KNMI. De respondent geeft aan dat hij samenwerking tussen organisaties als RIVM en de universiteit of 'instituut-kant' belangrijk vindt. Ook noemt hij organisaties binnen Wageningen UR, waaronder Alterra, ESG (Environmental Science Group) en ASG (Animal Science Group). De respondent geeft ook aan dat hij onafhankelijkheid van onderzoeksinstituten belangrijk vindt, dat het goed is dat verschillende onderzoeksgroepen met hetzelfde bezig zijn, en dat discussie belangrijk is om vooruit te komen maar niet eeuwig moet duren.

3. Welke inzichten en/of onderzoeksresultaten zijn relevant voor burgers en lezers van de krant? Een van de onderwerpen waarover volgens de respondent gecommuniceerd moet worden richting burgers is de huidige situatie in de landbouw. Hij vertelt dat hij het belangrijk vindt dat er een realistisch beeld bestaat van hoe het er in de veehouderij aan toe gaat en, en dat dit momenteel niet altijd het geval is. Hij geeft de discussie over weidegang als voorbeeld. Ook geeft hij aan dat communicatie vanuit de wetenschap/onderzoek kan bijdragen aan een stijging van het algemene kennisniveau, en dat mensen met een mening over de situatie (de huidige veehouderij) ook verstand zouden moeten hebben van de situatie. Daarnaast spreekt de respondent over de connectie tussen broeikasgasemissies, dierenwelzijn, milieu en volksgezondheid (waaronder overgewicht). Ook noemt de respondent meta-onderzoek. Hij geeft aan het goed te vinden als er gecommuniceerd wordt over onderzoek waarbij verschillende facetten van veehouderij worden vergeleken, en wanneer veehouderij/landbouw met andere sectoren zoals transport of industrie wordt vergeleken. Tenslotte geeft de respondent aan het goed te vinden als mensen uit de onderzoekswereld zich uitspreken in de media, maar dat het lastig is wanneer zij verschillende standpunten moeten vertegenwoordigen (zoals Louise Fresco en Aalt Dijkhuizen). Ook is het volgens de respondent van belang bij onderzoek te communiceren wat er onderzocht is en ook vooral wat er nog onduidelijk is.

4. Wat is de mening van de respondent over verschillende discussiepunten en onduidelijkheden uit de media?

De potentiële bijdrage van verminderde vleesconsumptie: de respondent geeft aan dat het een kwestie van is van 'minder, en er ook meer geld voor over hebben'. Hij koppelt dit ook aan overgewicht en gezondheid.

Biologisch of conventioneel: de respondent geeft aan dat op zowel biologisch als conventioneel gebied mensen met het onderwerp bezig zijn, en in onderzoek niet per se onderscheidt wordt gemaakt tussen deze twee terreinen. Er zou wel meer samenwerking en integratie plaats kunnen vinden tussen Biologisch en Conventioneel, niet alleen in de wetenschap, maar ook in de praktijk.

Grootschalig of kleinschalig: de respondent vertelt dat sommige mensen niet meer goed weten wat goed is voor een dier en denken dat kleiner altijd beter is. Hij geeft hierbij het voorbeeld dat een klein keutelboertje mogelijk minder goed is voor zijn dieren dan een groot bedrijf. Hierbij geeft hij ook aan dat het niet handig zou zijn overal gebouwen neer te zetten, en dat planten ook geïndustrialiseerd kunnen worden.

Lokaal of mondiaal: emissies kunnen lokaal, regionaal en mondiaal erg verschillen, aldus de respondent. Daarnaast zou volgens hem bijvoorbeeld graan niet per se uit Europa hoeven te komen, maar zou mest ook teruggebracht moeten kunnen worden naar plaatsen waar voedingsstoffen in eerste instantie vandaan komen. Ook benadrukt de respondent hier de grenzen aan invloed van Nederland, sommige problemen zoals kringlopen kloppend maken moeten toch wel mondiaal aangepakt worden, of misschien in ieder geval per continent.

Is een koe efficiënte eiwit-omzetter? Volgens de respondent zijn in principe alle dieren inefficiënt. Maar er zijn volgens hem ook plaatsen waar geen akkerbouw mogelijk is, en daar is veehouderij een goede optie.

Hoe groot is de bijdrage van veehouderij aan het klimaatprobleem? En hoe zit het met de Nederlandse situatie? Dat de veehouderij 18% bijdraagt aan de emissies van broeikasgassen zou volgens de respondent wel kunnen kloppen. Hierbij geeft hij aan dat Nederland slechts een klein onderdeel is van een veel groter geheel (een klein stipje op de kaart), maar dat Nederland ook voorop loopt in ontwikkeling. Volgens de respondent is men in Nederland kritisch, is er een hoge standaard en resulteert dit ook in ontwikkeling, maar is het belangrijk de bijdrage van veehouderij aan broeikasgasemissies in verhouding te zien tot de economische bijdrage van deze sector (BPM). Ook dient de Nederlandse situatie in verhouding te worden gezien tot andere regio's zoals Afrika, Zuid-Amerika, Azië en Noord-Amerika die minder ver ontwikkeld zijn.