

# A framing theory-based content analysis of a Turkish newspaper's coverage of nanotechnology

Erdal Şenocak

Received: 14 February 2017 / Accepted: 7 July 2017 / Published online: 19 July 2017  
© Springer Science+Business Media B.V. 2017

**Abstract** This study aims at examining how nanotechnology is covered in Turkish print media. As an initial part of this objective, a total of 76 articles derived from a widespread national newspaper were analyzed based on the framing theory. These articles were analyzed using both quantitative and qualitative traditions of content analysis; however, the quantitative method was the primary form of investigation. The analyses showed that the first news about nanotechnology appeared in 1991 and the frequencies of articles had increased in the subsequent years; but the number of articles had decreased after a while. The findings demonstrated a remarkable positive tone in the articles; there were only a few articles in negative tones and these articles were published in the first years of nanotechnology news. It was further found that the articles were mostly concerned with the implementations of nanotechnology, such as research and education centers, medical, and electronics. The study also investigated the presentation style of nanotechnology news. In other words, it investigated how the articles were framed. The results showed that the articles were mostly framed with scientific researches or discoveries and future expectations.

**Keywords** Nanotechnology · Media · Framing theory · Content analysis · Societal implications

## Introduction

The business world in many countries allocates huge amounts of money and human power to nanotechnology research. Even though nanotechnology investments in Turkey may have started late, the first steps were taken in the early 2000s. In 2007, the National Nanotechnology Research Center (NNRC) was established with the joint effort of the State Planning Organization and Bilkent University. The center has been performing research and development studies on nanotechnology and at the same time offering graduate education. Besides the NNRC, numerous other research centers were established with the support of the public and private sectors. Some of these centers are Tübitak Marmara Research Center Materials Institute, Sabancı University Nanotechnology Research and Application Center, and Hacettepe University Nanotechnology and Nanomedical Science Center. In addition, the country has been hosting an annual national nanotechnology congress since 2005 and a national nanotechnology student congress since 2011. Nanotechnology was highlighted among the most privileged and profitable strategic technology fields in the national science and technology plan of Turkey (Tubitak 2004). As stressed in the relevant literature, no matter how promising an emerging technology is, it needs public support to receive investments and grow (Scheufele and Lewenstein 2005; Siegrist 2010;

---

E. Şenocak (✉)  
Department of Math and Science Education, College of Education,  
Gaziosmanpaşa University, 60140 Tokat, Turkey  
e-mail: e\_senocak\_2000@yahoo.com

Vandermoere et al. 2011). The ultimate success of technologies depends on people's attitudes, support, and understanding of the benefits and possible risks of these technologies (Currall et al. 2006). This is the case with nanotechnology as well. Senocak (2014) studied the nanotechnology perceptions of the Turkish public and revealed that people had considerably positive attitudes towards nanotechnology, but they had little knowledge about it and gained their knowledge mainly through the media such as the internet, TV, newspapers, or magazines. Also, Karamanlioğlu and Güzeloğlu (2010) examined nanotechnology news in Turkish media. They found that nanotechnology was represented mostly in terms of its economic aspects, and news tone was quite positive.

The study aims to analyze nanotechnology news in Turkish print media. Despite the presence of an earlier study on the topic, the present one is different in several ways. For example, while the earlier study by Karamanlioğlu and Güzeloğlu (2010) examined the nanotechnology news only between 2005 and 2009, the present study did not limit itself to certain years and therefore analyzed all the articles between the first mention of the word nanotechnology in newspapers until 31 December 2015. In this respect, the development and changes in nanotechnology-related coverage over time will also be revealed in detail. The reason behind examining the media coverage is that media informs the public about new scientific and technological developments. Especially when the public has little or no information about an emerging technology, media coverage becomes even more important in allowing the public to understand and evaluate this technology (Scheufele and Lewenstein 2005). Many studies have shown that mass media have significant effects on the awareness, perceptions, and even public behaviors of the public such as buying and voting (Macnamara 2005). Owing to the close relation between public opinion and media coverage, nanotechnology news in the media has come to be an important research topic (Kulve 2006).

The study was also conducted based on the framing theory. This theory is commonly used in the analyses of media coverages. Framing theory is based on the idea that people's perceptions are likely to be affected when media messages are presented within certain frames (de Vreese 2005). According to Entman (1993, p. 52), "*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.*" In the framing approach, frames have the power to influence perceptions and shape opinions of the general public by emphasizing certain aspects of a subject. The ability of media messages to shape people's thoughts is important. The framing theory was used in the analysis of many media subjects ranging from social issues such as drug use and strikes to election campaigns and political communication (Hallahan 1999). The theory was also used for the analysis of news related to natural sciences. To illustrate, many topics difficult for the public to understand, such as genetically modified organisms (Marks et al. 2007; Listerman 2010; Aksoy 2012), biotechnology (Kohring and Matthes, 2002; Ten Eyck 2005), nanotechnology (Kulve 2006; Kjærsgaard 2010; Lemańczyk 2013), nuclear energy (Gamson and Modigliani, 1989; Entman and Rojecki, 1993) and global warming (Olausson 2009), were examined through the framing theory.

This study is also important because it analyzes the media news of Turkey, which is a developing country. Turkey has a long and distinguished record as a center of civilization. Turks played an active role in the pursuit of scientific and technologic developments throughout its history. However, Turkish society kept far away from industrial revolutions especially in the Ottoman period. Now Turkey, as a young country, is targeting a competitive and sustainable development by taking the right steps in the field of technology. Also, Turkey has been implementing educational reforms since the Republic was established in 1923. The focus of early educational reform movements was simple literacy. But now, there are on-going reform initiatives in K-12 education programs. As part of these reform efforts, the science, technology, and society education was integrated into the curriculum. The aim of the curriculum is to promote the development of scientifically and technologically literate citizens. Despite a considerable effort in raising scientific literacy citizens, research on different groups from Turkish society has shown that the majority of people has moderate or insufficient level of science literacy (Özdem et al. 2010; Türkmen and Özdemir, 2013). In a comprehensive survey, including Turkey and other European countries, the civic scientific literacy of adults was measured. The results of the study showed that Turkey was among the countries with the lower percentages of scientifically literate

adults (Miller, 2006). Also, a study showed that the media was the primary source of knowledge about scientific issues for the public and most of people pointed out the media as their knowledge source, only a few people expressed school as their knowledge source (Senocak, 2014). In other words, the media is an important factor influencing the Turkish public's thoughts. Despite these preliminary findings, there is a need for further studies to gain more detailed information about the media news and the effect of media on Turkish public ideas.

## Method

Aiming at analyzing nanotechnology articles in Turkish print media, the study examined many factors in the articles but focused particularly on the frames and themes used in the articles. This study was conducted using a mixed content analysis method—an approach that combines quantitative and qualitative methods—in order to investigate the targeted issues in the articles. Content analysis investigates separate studies conducted in a specific content area by creating matrixes. In this way, it reveals a better understanding of the general framework of the research topic being investigated (Çalık and Sözbilir 2014). Berg (2001) defines content analysis as a technique of systematically and objectively identifying the qualities of textual messages and making inferences. Strelakova (2015; p. 169), on the other hand, defines it as *a tool coupled with framing and topical analysis which provides important insights about thematic coverage of an issue*.

Content analysis is used to study texts which are verbal, written, or electronic, and these texts could be obtained from newspapers, magazines, and radio or TV programs (Kondracki and Wellman 2002; Macnamara 2005). Content analysis has often been used to examine how the media reflects social and cultural issues and values (Thompson 2011). The method is used extensively in the analysis of print, visual, and social media content. It is particularly successful in helping researchers reveal the big picture of a specific topic (Deacon et al. 1999). Even though many studies analyze framing in the media, some researchers have expressed concerns about the validity and reliability of the approaches used in these studies (Miller 1997; Scheufele 1999). For instance, Matthes and Kohring (2008) define the concept of frame as a rather abstract variable that is hard to define and code

in content analyses and suggest a new content analysis approach for the examination of this concept. Van Grop (2005) mentions the difficulty in eliminating researcher bias in frame analysis studies, while Maher (2001) stresses the difficulty in measuring the concept of frame. Accordingly, it is clear that frame is a concept that is hard to explore and measure. Therefore, it is important that a valid and reliable method be used in identifying news frames. Certain researchers claim that media analyses should employ quantitative content analyses (Berelson 1952; Neuendorf 2002), while others advocate qualitative content analysis (Newbold et al. 2002). Others like Shoemaker and Reese (1996) contend that both approaches have their pros and cons and that use of a mixed approach could thus be ideal in media analyses. Many researchers indeed agree that the best way to reveal the possible effects and meanings of media messages is to use a combination of quantitative and qualitative approaches (Macnamara 2005; Thompson 2011). For instance, Halloran (1998) points out that social science research problems have a complex nature and their comprehensive study often requires a mixed-method approach in order to engage more fully with the issues. Similarly, Stokes (2003) argues that use of two or more research methods contributes to a more in-depth understanding of the research problem. In line with these suggestions, the present study analyzed nanotechnology news in the print media by using the mixed research approach with an emphasis on quantitative analysis.

Quantitative content analyses were used as the primary research method, and many of the findings were based on the quantitative data. Qualitative analysis was used as the secondary method. The technique used here was the directed content analyses method, which was applied extensively in many previous studies as well. When this technique is used, media messages are analyzed with standard codes by using frames observed in the existing literature (de Vreese et al. 2001; Igartua et al. 2005; Semetko and Valkenburg 2000). However, using standard codes may result in omitting some potential frames. In order to overcome this problem, a flexible coding scheme was constructed with frames obtained from the literature. Flexibility means that new frames may be added to the scheme as they emerge from the text during the analyses. As the study concerns itself with frames and themes in newspapers, these terms should be defined. The term frame has long been used in media research and defined in many ways. For instance, while Gamson and Modigliani (1989; p.143)

define the term frame as *a central organizing idea or story line that provides meaning to an unfolding strip of events*, Scheufele and Tewksbury (2007; p.12) define it as *an invaluable tool for presenting relatively complex issues efficiently and in a way that makes them accessible to lay audiences.....* Lemańczyk (2011, 2012), on the other hand, states that a frame gives information about how the content of a text is presented (i.e., “how is the story told”) and therefore embodies the presentation style of the story. In this study, the term frame is taken to be a central organizing message for making a topic more specific and clear in people’s mind. Lemańczyk (2011, 2012) defines theme as a term that represents the content of a particular text (i.e., “what is the story about). For example, a new nanotechnology application, training program or a patent that comprises the content of a news story may be its theme. In the present study, the themes were handled in the way suggested by Lemańczyk (2011, 2012).

#### Population and sample

The population of the study comprised the national newspapers printed in Turkey. The sample was one of these newspapers that has been in print since the 1980s. The sample was chosen with the non-random sampling method of convenience sampling. This approach was chosen as nanotechnology first appeared in newspapers in the 1980s with few articles (Stephens, 2005; Thompson, 2011). One of these newspapers was selected to get nanotechnology news. The selected newspaper has continuous print and nationwide distribution since the 1980s, whose entire web archive is also accessible. The reason why the other newspapers were not included in this study was related to their accessibility. None of the other newspapers’ web archives allowed full access. Following this, the electronic archive of the selected newspaper was scanned by using the keyword “*nanotechnology*.” The word *nanotechnology* was chosen as a keyword because it was used in many other studies conducted on media coverage (Lemańczyk 2014). Seventy six (76) articles that contained a concrete reference to nanotechnology were derived from the newspaper.

Before analyzing the articles, intercoder reliability was tested because the analysis cannot be trusted if the coding is not reliable. Lombard, Snyder-Duch, and Bracken (2002) state that intercoder reliability is a crucial component of content analyses and that no inference

from data will be valid without establishing such reliability. They also claim that for coder reliability, the sample to be coded should constitute no less than 10% of the entire data (Lombard et al. 2002). In this regard, a random sample (25%,  $n = 18$ ) of the articles was coded independently by the author and by a second coder. For the coding data, percent agreement and Cohen’s kappa coefficient were calculated. The calculations yielded a percent agreement value of .71 and a Cohen’s kappa value of .63. A percent agreement between .70–.80 is acceptable (Miles and Huberman 1994), and a Cohen’s kappa coefficient between .61–.80 suggests a substantial agreement (Landis and Koch 1977). These findings suggested an acceptable level of agreement between the coders.

#### Data collection tools and analysis

The first step in the study was to identify a widespread national newspaper. Following this, all the articles featuring information about nanotechnology between 1 January 1980 and 31 December 2015 were selected. Then each article was analyzed by using a coding scheme. This coding scheme was developed in accordance with former studies of media debates on emerging technologies. The scheme included the following quantitative details: the date of the article published, author of the article, and type of the article. The goal in collecting these data was to explore the change in nanotechnology news over the years, to see who wrote these articles, and to identify the source of the news. After this step, the coder read each article in detail and determined its leading frame and theme. Finally, the country in question, the benefits and risks of nanotechnology, and the general tone of the articles were determined through detailed reading.

As emphasized before, the flexible coding scheme designed for the news analysis included frames used commonly in the analysis of nanotechnology news. These frames were previously used in many other studies focusing on the analysis of nanotechnology news, and they also had the potential to be used in the articles appearing in the Turkish media. Some examples of the frames used in the scheme and of the studies involving these frames were as follows: scientific research and discovery (Ling 2005; Stephens 2005; Anderson et al. 2005; Anderson et al. 2009; Kjærsgaard 2010; Karamanlioğlu and Güzeloğlu 2010; Groboljsek and Mali 2012; Donk et al. 2012), economy

(Ling 2005; Stephens 2005; Anderson et al. 2005; Anderson et al. 2009; Kamanlioğlu and Güzeloğlu 2010; Kjærgaard 2010; Dudo et al. 2011a, b; Groboljssek and Mali 2012; Donk et al. 2012; Lemanczyk 2013, 2014), ethics, moral and social values (Stephens 2005; Groboljssek and Mali 2012; Lemanczyk 2013), political arrangements and implementations (Ling 2005; Groboljssek and Mali 2012), future applications (Kamanlioğlu and Güzeloğlu 2010; Kjærgaard 2010; Lemanczyk 2011; Lemanczyk 2013), and national success (Lemanczyk 2012, 2014). Although the national success frame was used only by one researcher, it was included among the frames in this study. Lemanczyk (2012, 2014) invented this frame in his study of the media of Poland and Iran. He stated that this frame was used particularly by the media of developing countries to stress national success in nanotechnology. It was thought that the Turkish media might use this frame as well. Therefore, it was included in the coding scheme. No standard path was followed for the selection of the themes to be used in news analyses as there was a wide spectrum of them and coming up with a standard list was very difficult. Therefore, general themes were used, and the scheme was kept flexible for new themes to be added to it during the analyses.

The study was organized in three sections. In the first section, a widespread national newspaper was determined to get nanotechnology articles. In the second section, the articles were obtained by using the keyword nanotechnology. In the last section, the articles were analyzed by using coding scheme.

## Results

The first results of the analysis showed that the first article on nanotechnology appeared in 1991 and that the number of the articles between 1991 and 2015 was 76. When analyzed by years, the number of the articles increased until 2010 but decreased thereafter. According to Fig. 1, nanotechnology news was most frequent between 2007 and 2010. The highest number of the articles was 16 in 2010.

Other details regarding the articles concerned the author of the articles and the article type. Table 1 shows that there were no data in relation to the author of majority of the articles (67.1%). Journalists produced only one quarter of the articles (25%). The findings also

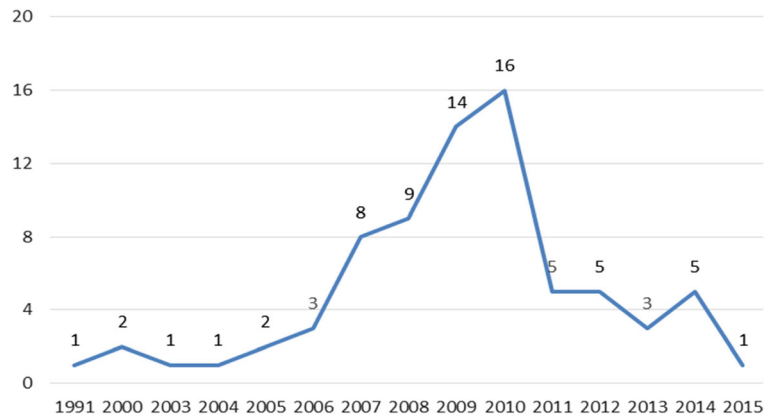
revealed that a few articles were written by scientists. As for the article type, similarly to the findings regarding the authors of the articles, there were no data related to the article type in a considerable number of the articles (44.7%). The rest of the articles featured news or quoted passages. Moreover, there was no article based on an interview.

The primary purpose of the present study was to identify the frames and themes used in nanotechnology news. The findings obtained can be seen in Table 2. According to the findings, eight different frames were discussed in the articles. Scientific research or discovery was the most discussed frame in the articles. The second place was occupied with the frame of future applications of nanotechnology. Also, in the third place were political decisions and regulations, national success, and education and career advice. In terms of themes, nanotechnology research and education centers were the most discussed theme in the articles. Medicine and electronic applications of nanotechnology occupied the second and the third places in the themes of the articles. Also, seminar or conference was another salient theme that appeared in the articles. Although they were not discussed frequently in the articles, nano business and R&D emerged as unforeseen frame or theme in the analysis of the news.

The findings regarding the focus country in the news are shown in Table 3. As can be seen, Turkey was the most frequently mentioned country in the articles. Nanotechnology news focused on the achievements of Turkish scientists or companies. Also, cooperation between countries, especially European countries, was another important finding that the articles focused on.

Other details regarding nanotechnology news analyses involve benefits and risks of nanotechnology and general tone of the articles. These variables are seen as important factors influencing public understanding and acceptance of emerging technologies (Strekalova 2015). The findings in relation to these variables are presented in Table 4. According to the findings, the articles mainly focused on the actual or potential benefits of nanotechnology (61.8%). Only 3.9% of the articles were about risks of nanotechnology, and these articles were published in 2000. Also, a considerable number of articles discussed neither benefits nor risks of nanotechnology. As for the findings regarding the general tone of the articles, there was a positive tone dominating most of the coverage (68.4% of all the articles), and

**Fig. 1** Distribution of nanotechnology news over the years



only a small percentage of the articles had a negative tone (7.9%). Moreover, a bit less than one quarter of the articles (23.7%) had a neutral tone.

## Discussion and conclusion

The first findings of the study were related to how the nanotechnology coverage changed across time between 1980 and 2015. The findings showed that the earliest nanotechnology article appeared in 1991 and that the number of the articles increased until 2010 and then decreased dramatically. Also, the largest increase occurred between 2006 and 2010. The reason for this increase in the number of the articles in this period might be due to the nanotechnology research and education centers. Many of these centers were opened in this period, and the media reported news about these openings. These findings suggest a recent decrease in the interest in nanotechnology coverage in the media. Similar findings were also obtained in media coverage studies in other countries (Dudo et al. 2011b; Veltri and Crescentini 2011). For example, Dudo et al. (2011b) studied on U.S. newspaper coverage about nanotechnology between 1998 and 2009. They found that the amount of newspaper coverage of nanotechnology increased till 2006 and that a decrease began till 2009. Similarly,

Kjærsgaard (2010) found that the number of the articles on nanotechnology in the Danish national newspapers increased continuously until 2004 and then radically decreased.

The findings related to the article authors revealed that there were no data regarding the author of the majority of the articles and that only a small part of them were written by scientists. There was a low presence of scientists as authors of articles in relation to nanotechnology. There may be different reasons why scientists weren't involved in the media nanotechnology debate. For example, in a study on scientists' views regarding the media, Peterson and Anderson (2009) stated that although scientists recognized the importance of the media on the debates of science and technology issues, in some cases they were mistrustful of the media and tried to limit their engagement. However, it is difficult to state a certain reason for them not to present their scientific field to larger audiences through the media messages according to the findings of the study. In addition, most of the articles (72.3%) did not include any information about the source, or they were extracted from another source.

Looking at the findings regarding the frames of media coverage of nanotechnology, as stated before, the articles were mostly framed within scientific research or discovery on nanotechnology. Also, future applications expected from nanotechnology constituted a frame in a

**Table 1** Frequency of articles by article authors and article types

Article author	<i>f</i>	%	Article type	<i>f</i>	%
Journalist	19	25	Featured news	21	27.6
Scientist	6	7.9	Quoted passage	21	27.6
No data on author	51	67.1	No data on article type	34	44.7

**Table 2** Frequency of article frames and themes

Frames	<i>f</i>	%	Themes	<i>f</i>	%
Scientific research or discovery	38	50	A new education program	4	5.3
Economy	4	5.3	Seminar or conference	10	13.2
Political decisions and regulations	6	7.9	Research and education center	13	17.1
Ethics, legal, and societal implications	1	1.3	Medicine	12	15.8
Future applications	13	17.1	Military	4	5.3
National success	6	7.9	Automotive	4	5.3
<sup>a</sup> Nano business	2	2.6	Robots	5	6.6
Education and career advise	6	7.9	Electronics	11	14.5
			Textiles	4	5.3
			Awards (Nobel prize, etc.)	6	7.9
			<sup>a</sup> R&D	2	2.6
			Job opportunities	1	1.3

<sup>a</sup> Frame or theme emerged during the analyses

significant number of the articles. It is worth noting that there was only one article about the ethical, legal side of nanotechnology and about its effects on social values. The findings regarding the themes of the articles revealed that a large proportion of the articles featured nanotechnology research and education centers, medicine, electronics, and seminars or conferences. The findings regarding the themes were partly parallel to the existing literature. To illustrate, nanotechnology applications in medicine and electronics are prominent in the media of many other countries, too. However, the focus on research centers and seminars seems to be unique to Turkish media. This may have been due to the opening of several nanotechnology research centers in the country between 2005 and 2010 such as the National Nanotechnology Research Center. It is clear that such developments found themselves a place in the media. As mentioned above, a flexible scheme was built prior to

the coding of the articles. This scheme was based on the frames and themes in the current literature. However, the study also showed that certain themes in the current literature did not appear in Turkish media. For instance, subjects such as sports equipment, cosmetics, or food packaging were not discussed by the Turkish media despite their intensive use of nanotechnology. On the other hand, there are some studies in the relevant literature which showed that the media discussed these subjects from different aspects. For example, Lemańczyk (2011) examined Polish press coverage of nanotechnology. The study revealed that Polish press focused especially on the safety of cosmetics with nanoparticles. In another study, Dudo et al. (2011a) studied on the evaluation of U.S. newspaper coverage of food nanotechnology. They found that quality/safety theme appeared most often in newspaper coverage of food nanotechnology. In a study on news about nanotechnology, Thompson (2011) focused an article discussing the

**Table 3** Frequency of article by country in focus associated with nanotechnology

Country in focus	<i>f</i>	%
Turkey	51	67.1
Another country	9	11.8
Competition of countries	1	1.3
Cooperation between countries	7	9.2
International relations	6	7.9
No data on any country	2	2.6

**Table 4** Frequency of articles by benefits and risks of nanotechnology and general tone of articles

Benefits–risks	<i>f</i>	%	Tone	<i>f</i>	%
Benefits outweigh risks	47	61.8	Positive	52	68.4
Risk outweighs benefits	3	3.9	Negative	6	7.9
Both	2	2.6	Neutral	18	23.7
None	22	28.9			

risks of the tiny particles commonly used in products such as sports equipment. The reason why these subjects were not included in the Turkish media may be the Turkish media perspective of nanotechnology because the overall tone was much more positive. These subjects were discussed with their risk aspects in other countries' media. Another finding was the emergence of frames and themes which previously did not exist in the coding scheme. There were two articles with the frame of nanotechnology R&D studies and two with the frame of manufacturing nanotechnology products, namely nano business.

Another detail was related to which country the articles focused on, that is whether the article focused on nanotechnology in the context of Turkey or any other country. The findings demonstrated that the articles regarding Turkey dominated the newspaper. Also there were articles focusing on nanotechnology developments in other countries. These articles either focused on the achievements of scientists or companies of a country or relations between countries regarding nanotechnology. For example, an article published by Iranian scientists in 2015 focused on a drug development study for cancer treatment with nanotechnology. Another article focused on cooperation between a Turkish oil company and English research company to produce environmental friendly diesel fuel with nanotechnology. The final details in the study were about the extent to which the articles treated the benefits and risks of nanotechnology and about the general tone of the articles. The finding revealed that the articles mostly focused on the benefits of nanotechnology. The positive language employed in the articles and the emphasis on the benefits of nanotechnology are worth noting as well. A previous study (Şenocak 2014) showed that the Turkish public has generally positive attitude towards nanotechnology. The reason of the positive attitudes expressed by people may be linked to the positive perspective being conveyed by the media because media coverage is one of the factors affecting people's views and acts as the primary source of information for the public about emerging technologies, especially in the early stages of the debate. Although people from some countries tend to be more critical about nanotechnology, in many countries, both the public's attitudes towards nanotechnology and media coverage of nanotechnology are mainly positive. For example, Gaskell et al. (2005) found that the U.S. public, a techno-optimistic country, was much more positive than the E.U. citizens, skeptical countries,

about nanotechnology. The same case is also occurring in the small countries such as Slovenia (Mali and Groboljsek 2012), or countries with limited media options such as Iran (Lemanczyk 2014). Further, Metag, and Marcinkowski (2014) found that negativity bias was not supported by the media coverage of nanotechnology. On the contrary, the media promoted nanotechnology rather than demonizing it. Therefore, it is not surprising that both the Turkish media coverage of nanotechnology and the public attitude towards nanotechnology are positive and benefit-oriented.

Even though the findings show that, parallel to the global media, Turkish print media covers nanotechnology developments, there is also evidence that the Turkish media does not yet have an understanding of steady news-making fed by expert sources. The fact that the sources of many articles in the media were obscure and that there were few articles written by journalists or scientists emerged as a significant finding. It is worth noting that in the media of some countries, nearly 90% of nanotechnology news are written by journalists or scientists (Groboljsek and Mali 2012). Another significant finding was that Turkey was the most commonly mentioned country in the news and that most articles had a positive tone.

In conclusion, the present study may seem to have the limitation of focusing on one newspaper alone. However, it is believed that the study will make a significant contribution to the literature as it focuses on a large historical interval and uses detailed analyses. It is also believed that the details emerging from the study will help the media and nanotechnology researchers to build new arguments for future studies. As mentioned before, nanotechnology could be said to be still new in Turkey, and it needs support so that Turkish public can understand it correctly in terms of its benefits and possible risks. Therefore, the Turkish media content may go beyond its current situation in order to increase public knowledge of nanotechnology. Based on the findings of the study, it could be stated that the media could use more nanotechnology news authored by scientists and experts rather than taking news from other sources regarding nanotechnology. It is also recommend that the media should focus more on the possible risks of nanotechnology because it has more risks than the media discussed. Finally, this study can be treated as a starting point for further research that would include broader variety of newspapers and wider range of details about nanotechnology news.

## Compliance with ethical standards

**Conflict of interest** The author declares that he has no conflict of interest.

## References

- Aksoy S (2012) Framing the debates regarding to genetically modified organisms in the Turkish press. *J Selcuk Commun* 7:191–205
- Anderson A, Allan S, Petersen A, Wilkinson C (2005) The framing of nanotechnologies in the British newspaper press. *Sci Comm* 27:200–220
- Anderson A, Petersen A, Wilkinson C, Allan S (2009) *Nanotechnology, risk and communication*. Palgrave Macmillan, New York
- Berelson B (1952) *Content analysis in communication research*. Hafner, New York
- Berg BL (2001) *Qualitative research methods for the social sciences*. Allyn and Bacon, Boston
- Çalık M, Sözbilir M (2014) Parameters of content analysis. *Edu Sci* 39:33–38
- Curral SC, King EB, Lane N, Madera J, Turner S (2006) What drives public acceptance of nanotechnology? *Nat Nanotech* 1:153–155
- de Vreese CH (2005) News framing: theory and typology. *Inform Design J* 13:51–62
- de Vreese CH, Peter J, Semetko HA (2001) Framing politics at the launch of the Euro: a cross-national comparative study of frames in the news. *Polit Commun* 18:107–122
- Deacon D, Pickering M, Golding P, Murdock G (1999) *Researching communications: a practical guide to methods in media and cultural analysis*. Arnold, London
- Donk A, Metag J, Kohring M, Marcinkowski F (2012) Framing emerging technologies: risk perceptions of nanotechnology in the German press. *Sci Commun* 34:5–29
- Dudo A, Choi D, Scheufele DA (2011a) Food nanotechnology in the news. Coverage patterns and thematic emphases during the last decade. *Appetite* 56:78–89
- Dudo A, Dunwoody S, Scheufele DA (2011b) The emergence of nano news: tracking thematic trends and changes in U.S. newspaper coverage of nanotechnology. *J Mass Commun Quart* 88:55–75
- Entman RM (1993) Framing: toward clarification of a fractured paradigm. *Aust J Commun* 43:51–58
- Entman RM, Rojecki A (1993) Freezing out the public: elite and media framing of the U.S. anti-nuclear movement. *Polit Commun* 10:155–173
- Gamson WA, Modigliani A (1989) Media discourse and public opinion on nuclear power: a constructionist approach. *Am J Soc* 95:1–37
- Gaskell G, Ten Eyck T, Jackson J, Veltri G (2005) Imagining nanotechnology: cultural support for technological innovation in Europe and the United States. *Pub Underst Sci* 14:81–90
- Groboljsek B, Mali F (2012) Daily newspapers' views on nanotechnology in Slovenia. *Sci Commun* 34:30–56
- Hallahan K (1999) Seven models of framing: implications for public relations. *J Pub Relat Res* 11:205–242
- Halloran JD (1998) Mass communication research: asking the right questions. In: Hansen A, Cottle S, Negrine R, Newbold C (eds) *Mass communication research methods*. Macmillan, Houndsmills, Basingstoke, Hampshire and London
- Igartua JJ, Cheng L, Muniz C (2005) Framing Latin America in the Spanish press: a cooled down friendship between two fraternal lands. *Commun: The Eur J Commun Res* 30:359–372
- Karamanlioğlu EB, Güzeloğlu C (2010) Frames about nanotechnology agenda in Turkish media, 2005–2009. *Int J Soc Behav Edu Eco and Manag Eng* 4:67–74
- Kjærgaard RS (2010) Making a small country count: nanotechnology in Danish newspapers from 1996 to 2006. *Pub Underst Sci* 19:80–97
- Kohring M, Matthes J (2002) The face(t)s of biotech in the nineties: how the German press framed modern biotechnology. *Pub Underst Sci* 11:143–154
- Kondracki NL, Wellman NS (2002) Content analysis: review of methods and their applications in nutrition researches. *J Nutr Edu Behav* 34:224–230
- Kulve HT (2006) Evolving repertoires: nanotechnology in daily newspapers in the Netherlands. *Sci as Cult* 15:367–382
- Landis JR, Koch GG (1977) The measurement of observer agreement for categorical data. *Biometrics* 33:159–174
- Lemańczyk S (2011) European societies and emerging technologies—debate on nanotechnology in Polish and Swedish press. *Int J Soc Sci Hum Stud* 3:1309–8063
- Lemańczyk S (2012) Between National Pride and the scientific success of “others”: the case of Polish press coverage of nanotechnology, 2004–2009. *NanoEthics* 6:101–115
- Lemańczyk S (2013) Debate on nanotechnology in the Swedish daily press 2004–2009. *Innov: The Eur J Social Sci Res* 26: 344–353
- Lemańczyk S (2014) Science and National Pride: the Iranian press coverage of nanotechnology, 2004–2009. *Sci Commun* 36: 194–218
- Ling A (2005) A report on Canadian and American news media coverage of nanotechnology issues <https://www.nanotechproject.org/publications>. Accessed 11 June 2016
- Listerman T (2010) Framing of science issues in opinion-leading news: international comparison of biotechnology issue coverage. *Public Underst Sci* 19:5–15
- Lombard M, Snyder-Duch J, Bracken CC (2002) Content analysis in mass communication: assessment and reporting of intercoder reliability. *Hum Commun Res* 28:587–604
- Macnamara J (2005) Media content analysis: its uses, benefits and best practice methodology. *Asia Pac Pub Relat J* 6:1–34
- Maher MT (2001) Framing: an emerging paradigm or a phase of agenda setting? In: Reese SD, Gandy OH, Grant AE (eds) *Framing public life: perspectives of media and our understanding of the social world*. Mahwah, NJ, pp 83–94
- Mali F, Groboljsek B (2012) Daily newspapers' views on nanotechnology in Slovenia. *Sci Commun* 34:30–56
- Marks LA, Kalaitzandonakes N, Wilkins L, Zakharova L (2007) Mass media framing of biotechnology news. *Public Underst Sci* 16:183–203

- Matthes J, Kohring M (2008) The content analysis of media frames: toward improving reliability and validity. *Aust J Commun* 58:258–279
- Metag J, Marcinkowski F (2014) Technophobia towards emerging technologies? A comparative analysis of the media coverage of nanotechnology in Austria, Switzerland and Germany. *Journalism* 15:463–481
- Miles MB, Huberman AM (1994) *Qualitative data analysis: an expanded sourcebook*, 2nd edn. Sage Publications, California
- Miller MM (1997) Frame mapping and analysis of news coverage of contentious issues. *Soc Sci Comp Rev* 15:367–378
- Miller JD (2006) Civic scientific literacy in Europe and the United States. A paper presented to the annual meeting of the World Association for Public Opinion Research, Montreal, Canada
- Neuendorf K (2002) *The content analysis guidebook*. Sage Publications, California
- Newbold C, Boyd-Barrett O, Van Den Bulck H (2002) *The media book*. Arnold, London
- Olausson U (2009) Global warming—global responsibility? Media frames of collective action and scientific certainty. *Public Underst Sci* 18:421–436
- Özdem Y, Çavaş P, Çavaş B, Çakıroğlu J, Ertepinar H (2010) An investigation of elementary students' scientific literacy levels. *J Baltic Sci Edu* 9:6–19
- Peterson A, Anderson A (2009) Scientists, nanotechnologies and the media. *Issues* 87:26–30
- Scheufele DA (1999) Framing as a theory of media effects. *Aust J Commun* 49:103–122
- Scheufele DA, Lewenstein BV (2005) The public and nanotechnology: how citizens make sense of emerging technologies. *J Nanopart Res* 7:659–667
- Scheufele DA, Tewksbury D (2007) Framing, agenda setting, and priming: the evolution of three media effects models. *Aust J Commun* 57:9–20
- Semetko HA, Valkenburg PM (2000) Framing European politics: a content analysis of press and television news. *Aust J Commun* 50:93–109
- Senocak E (2014) A survey on nanotechnology in the view of the Turkish public. *Sci Tech Soc* 19:79–94
- Shoemaker P, Reese S (1996) *Mediating the message: theories of influences on mass media content*. White Plains, New York
- Siegrist M (2010) Predicting the future: review of public perception studies in nanotechnology. *Hum Ecol Risk Assess* 16: 837–846
- Stephens LF (2005) News narratives about nano S&T in major US and non-US newspapers. *Sci Commun* 27:175–199
- Stokes J (2003) *How to do media & cultural studies*. Sage Publication, London
- Strekalova YA (2015) Informing dissemination research: a content analysis of U.S. newspaper coverage of medical nanotechnology news. *Sci Commun* 37:151–172
- Ten Eyck TA (2005) The media and public opinion on genetics and biotechnology: mirrors, windows or walls? *Public Underst Sci* 14:305–316
- Thompson S (2011) *News about nanotechnology: a longitudinal framing analysis of newspaper reporting on nanotechnology*. Bournemouth University, Dissertation
- Tubitak (2004) National Science and Technology Policies of Turkey [https://www.tubitak.gov.tr/tubitak\\_content\\_files/vizyon2023/Vizyon2023\\_Strateji\\_Belgesi.pdf](https://www.tubitak.gov.tr/tubitak_content_files/vizyon2023/Vizyon2023_Strateji_Belgesi.pdf). Accessed 31 May 2017
- Van Gorp B (2005) Where is the frame? Victims and intruders in the Belgian press coverage of the asylum issue. *Eur J Commun* 20:485–508
- Vandermoere F, Blanchemanche S, Bieberstein A, Murette S, Roosen J (2011) The public understanding of nanotechnology in the food domain. *Public Underst Sci* 20:195–206
- Veltri GA, Crescentini A (2011) The anchoring of nanotechnology in the Spanish National Press. *The Int J Sci in Soc* 2:127–137