

Frames about Nanotechnology Agenda in Turkish Media, 2005-2009

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Abstract—As the new industrial revolution advances in the nanotechnology have been followed with interest throughout the world and also in Turkey. Media has an important role in conveying these advances to public, rising public awareness and creating attitudes related to nanotechnology. As well as representing how a subject is treated, media frames determine how public think about this subject. In literature definite frames related to nanoscience and nanotechnology such as process, regulation, conflict and risks were mentioned in studies focusing different countries. So how nanotechnology news is treated by which frames and in which news categories in Turkey as a one of developing countries? In this study examining different variables about nanotechnology that affect public attitudes such as category, frame, story tone, source in Turkish media via framing analysis developed in agenda setting studies was aimed. In the analysis data between 2005 and 2009 obtained from the first five national newspapers with wide circulation in Turkey will be used. In this study the direction of the media about nanotechnology, in which frames nanotechnologic advances brought to agenda were reported as news, and sectoral, legal, economic and social scenes reflected by these frames to public related to nanotechnology in Turkey were planned.

Keywords—Agenda, frames, media, nanotechnology, Turkey.

I. INTRODUCTION

NANOTECHNOLOGY, is considered the industrial revolution of the 21st century. Futurists, who considered technological developments as a revolution waves guiding humanity said that improvements in nanotechnology has carried societies to the new wave [1] and these improvements have conveyed all technologies to converge. Through its characteristic structure, convergence in technologies has triggered a transition to the new wave leading transformation in the society [2]. Scientific and technological improvements in this century have been rebuilding the architecture of the world in 21st century by using building blocks of neurons, atoms and bytes [3]. Nanotechnology is the last technological revolution wave that has a potential to develop highly.

Analysis and reports show that almost in all countries researches and investments related to these technologies has been started. Like the early period of biotechnology development considerable funds were allocated for improvement of nanotechnology. According to Lux Researches, investments more than 4.6 billion dollars were made in a national scale in 2004. One third of these investments constituted American, Asian and European economies [4]. Global government funding in nanoscience and nanotechnology has reached 4 billion dollars from 432 million dollars between 1997 and 2005. In the same period investments has increased to 950 million from 120 million dollars in Japan. Government funding in other countries except EU, Japan and US was 1 billion dollars in 2005. EU countries with 1.1 billion dollars and US with 1.081 billion dollars have the highest shares of global investments [5]. In 2008 investment in nanotechnology-focused venture capital in Europe has been a small fraction of that of the US. An annual average is of the order of €20 – 40 million [6]. According Nanotechnology Market Forecast 2010 report, the global nanotechnology market is projected to grow 18% during 2010-2013. This prospective growth will largely be driven by massive investment in nanotechnology Research and Development (R&D) by both governments and corporates worldwide. The report also reveals that the Asia-Pacific region will experience the fastest growth in the market for nanotechnology enabled goods at a CAGR of nearly 52% between 2007 and 2013. The recent move by the emerging markets such as South Korea and China to concentrate on nanotechnology R&D will continue to play the most prominent role in the growth of nanotechnology [7].

Nanotechnology is not only a new technology but also is a new concept for societies. Activities related to nanotechnology were seen from every segment of the society to an every industrial branch. A film Star Trek, a novel Prey of the Michael Crichton, corporate activities in private sector such as NanoSys, organizations supported by government funds such as US National Nanotechnology Initiative, initiatives such as 21st Century Nanotechnology Research and Development Act, and other advances such as web sites, blogs, chat rooms, news media products indicate public attention and awareness about this technology in addition to scientific societies [8]. The most important reason of the increase in investments and funds throughout the world is the potential of the nanotechnology in solving global problems

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argued more frequently in this century about various issues such as health, environment and energy. This durum has been clearly mentioned in national programs and commission reports of the countries. For example, according to EU Commission 2009 report with the title of "Preparing for our future: Developing a common strategy for key enabling technologies in the EU" which considered nanotechnology as key enabling technology, this technology has the potential to be a solution for social and environmental problems related to issues in healthcare, energy, environment and manufacturing and improvements in this technology should be supported [9]. Other issue also stressed in the report is the need of public support in nanotechnology investments and success of scientific projects and public engagement in legal decision mechanisms. Researches show that public is willing to be informed and to participate actively in decision processes [10]. Providing an interaction between science and society is important for shaping ethical debates and public perception in a positive way. For instance, according to the EU-funded DEEPEN ('Deepening ethical engagement and participation in emerging nanotechnologies') project report, one major problem is the persistent belief that 'scientists do science, while society and ethicists deal with any ethical or social implications'. This reflects the assumption that the benefits of nanotechnology need to be pushed, and ethics is a 'brake on progress', the project partners argue [11]. In this point that science-society interaction was discussed how much information societies get about nanotechnology and nanotechnology related social and ethical discussions, which channels used for reaching such information and evaluation of the change in their attitudes are important issues.

II. THE RELATIONSHIP BETWEEN MEDIA AND PUBLIC ATTENTION

Scientific advances have become more specialized and complex than public general perception [5]. Being able to defragment every new scientific advance and innovations from different areas indicate the tendency of convergence of new technologies. Because its difficult to follow new advances emerge from different regions around the world with this tendency public have lack of information from scientific fields. In addition, there is need to specialized background information and interest related to the field for perception, embracement and evaluation of scientific knowledge. Nowadays various scientific subjects considered as unobtrusive for general public. News media also follow scientific and technological advances as well as all other issues relevant to public interest. Hence, any scientific information was obtained by general public composes of information provided by news media. However scope of the information forms in news content [12]. In other words media generates news contents related to technology by moving scientific advances to its agenda and to raise attention to the news try to focus and/or stress some points may related to the public in news content.

Nanotechnology as a concept has showed similar characteristics with the development of biotechnology. This technology affects health, science, industries and general economic developments. In respect of its characteristics it is quite unfamiliar to the public and related to products and services of this technology public is able to be informed only in a narrow scale [8]. Dialog is important for the advancement of nanotechnology. But it is mentioned that this dialog will be possible through two way communication between scientists, stakeholders and public [13]. Positioning of the science and technology via cognitive maps in minds and creating idea frames by information of science and technology, media is basis source [14]- [16]. Consequently, its mentioned that media will undertake important functions about public attitudes, awareness and acceptance for new technologies [8],[4],[13],[14],[17]. Media can also put forward reactions against nanotechnological developments by moving rising voices from public to its agenda. Media content will affect perceptions and visions in scientific area by conveying public demands as well as public perceptions related to nanotechnology to the science society [14]. By doing this media will act a part in providing two way communication between actors.

In reality, creating a dialog with not only scientists and individuals living in society but also variety of actor including decision mechanisms and investors is important. General public, other scientific fields, private organizations and capital owners with their funds are also affected media contents[14]. In the field of politics media should be followed for legal regulations providing integration of the nanotechnology to the public life. It is know that public attention has risen especially for subjects that science and politics are considered together such as global warming, evolution, stem cell researches [18]. Planning of legal regulations regarding technology towards public interests may strengthen interaction of public-politic field. Media is effective not only in public communication of politic actors but also shaping scientific and technology policies aimed at defining and eliminating uncertainties and disagreements [19].

However according to Life Sciences Communication Professor Dietram Scheufele nanotechnology has not taken media attention. In US, only 7 journalists gave more than 25 reports about nanotechnology. For this reason most of people have no information related to nanotechnology and nanotechnological advances [20]. Public awareness surveys about nanotechnology also mentioned that societies have not much more information about these new technologies yet. According to research results of Cobb and Macoubrie in 2004 and Scheufele & Lewenstein and Sheetz et al. in 2005 in US the familiarness of the nanotechnology remained around 17% [15],[21],[22]. In UK, according to the nanotechnological awareness survey of Royal Academy in 2004, 29% of the respondents mentioned that they heard nanotechnology but only 19% could describe nanotechnology [23]. Results of the awareness survey conducted with 1011 individual within the NRI Nanotechnology and Society Survey Project in 2004 was

more optimistic; the awareness rate 55.2% in Japan, 48% in US, 29% in UK was determined [24]. A recent survey report in 2008 with a name "Awareness of and Attitudes toward Nanotechnology and Synthetic Biology" within Emerging Nanotechnologies conducted by Peter D. Hart Research Associates showed that each three in four American has heard about just a little information or nothing about nanotechnology. In According to the report results only 7% of the American people heard many things about nanotechnology whereas 24% have a little interest [25]. In addition to the relationship between awareness of nanotechnology and number of news in media indicated by Scheufele the relationship between public opinions and media content about nanotechnology is also noteworthy. As it is known that when attention to the subjects rose in the news media readers paid more attention to the contents important for shaping public opinion [12]. While number of publication increases attention, content shapes attention. From this point of view preparing media contents related to the subjects functioning in public support requires professionalism.

Stephens mentioned a special field of expert related to preparing media contents about nanotechnology. Because of the complex structure of scientific knowledge, scientific advances and successes should be transformed into the media product for the general public. The need of transforming a media product put forward a new *third person* (generally scientific reporters) and expertise. This third person can give a direction to information and communication flow by acting as a bridge between scientists and non-scientific public. While doing this, third person reformulate scientific notation through more simple words [5]. Expressions reformulated by media contain some points that are intended to attract attention. How public debates related to the effects of nanotechnology will shape and which direction they proceed to will be controlled according to formulating/framing of the media [4]. From this view regarding the shaping perceptions, attitudes and choices, how media frames have built is a field of study that is required to analyze.

III. THE BACKGROUND OF THE CONCEPT OF FRAMING NANOTECHNOLOGY

Framing mechanisms are subjects dealt with frequently in media impact surveys. Studies searching issues about shaping attitudes related to nanotechnology framing mechanisms have been rising. Robert Entman who is a communication researcher claimed that frames are used to eliminate some items while put forward the others and mentioned that the shape of the framed issue can determine how individuals understand and evaluate the subject [26]. Framing appeared in second level of agenda setting in media surveys provides deeper look to the subjects and proposes the use of frames in telling people about how they should think about a subject [27],[28]. The fundamental element of framing is related to meanings imposed to subjects or objects. Hallahan mentioned that frames restrict or describe the meaning of the message by shaping inferences of individuals related to the message [29].

In framing, meaning impositions which direct towards shaping of the individual perceptions have a role of conceptualization and functionalization of the subjects. As a reflection of this, the fate of the public agenda takes shape with media decisions contained suggestions about not only what to think but also how to think while framing an issue as either abstract or concrete [30]. In news media, frames, subtitles, framing mechanism used in context are generated by using of emotional and conceptual elements [31]. In order to determine dominant frames directing ideas and opinions of the people news contents should be analyzed.

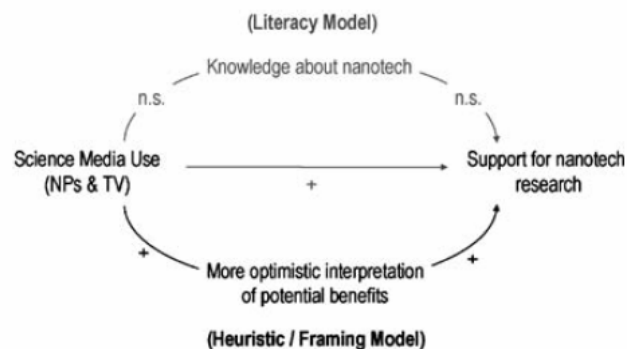


Fig. 1 Science Literacy and Heuristic Models of Attitude Formation[22]

In literature a model that symbolizes representing of the nanotechnology in media context and the process related to shaping of public perceptions and indicates framing mechanism is mentioned. Scheufele and Lewenstein proposed a heuristic/framing model regarding a relationship between consideration and acceptance of the nanotechnology and the decision process of the people related to this technology and claimed that this model is more functional than Literacy model related to attitude surveys regarding nanotechnology [22],[32]. In the study a relationship between approaching to the technology and being more optimistic about benefits of technology by using media and supporting nanotechnology researches was observed and phases of this relationship was explained a model (see Fig. 1).

In literature certain themes shaping attitudes of the societies to the nanotechnology were attempted to determine by making framing analysis with nanoscience and nanotechnology in studies focused on different countries. Regarding to this there are many studies conducted in developed countries but few studies dealing with developing and undeveloped countries in literature. Turkey also has not been examined yet. How nanotechnology news is reported by which frames and news categories in Turkey which is one of developing countries? In this study evaluating some variables affecting public attitudes such as category, frame, story tone and source by using framing analysis developed in agenda setting studies is aimed. Thus the direction of media agenda related to the nanotechnology, frames in which nanotechnologic advancements moved to the agenda and regarding to the

nanotechnology sectoral, legal, economical and social sciences reflected to the public can be analyzed.

IV. METHOD

Dominant content frames about technological subjects is related the usability of the technology however while more frames were provided by ignoring usability it is determined that media attention has increasingly risen [12]. In literature studies dealing with content analysis related to nanotechnology news different frames are determined. For example, Listerman focused subjects concerning whether human can control the nature or not and human-nature relationship is separated or integrated in his study was linked with cultural theory by himself and determined four basic framing categories as *utility, risk, control, fate* and *morality*[12]. Arias who examined news of New York Times, Washington Post, Wall Street Journal, and Associated Press, determined his frames as Progress, Economic prospects and opportunities, Ethical, Pandora's box, Runaway, Public accountability, Long way away and Confluence [33]. In Laing's study frames were arranged as Profiling new technologies, Societal risk/benefit discussion, Business and market news, Profiles of institutes or facilities, Economic impact, Regulatory, Legal and/or patent issues [8].

According to Pan and Kosicki, frames in news media texts should be evaluated not only in the aspect of syntactic structures and script structures but also in theme and rhetoric in structure analysis [34]. According to this point of views Faber examined news in nanotechnology and nanoscience concepts with frames of *theme, rheme, topic* and *representation* [14]. In the study of Weaver et al. subject frames of news contents are determined under four sets as *progress, regulation, conflict* and *generic risks* [35]. In Stephens's content analysis study about American media in 2005 [16] and Kjærgaard's content analysis study about Danish media in 2010 [36] similar frames generated according to sets of progress, regulation, conflict and generic risks were determined. In this study intended to analyze Turkish media content it is aimed to examine such frames determined in studies mentioned above. These frames are mentioned in the further sections in this study.

In the analysis data obtained from news archives between 2005 and 2009 of the most circulated five leading national newspapers in Turkey is used. The most important reason of searching web archives is the possibility of finding all of the specific scientific news which could not enter into newspaper pages but place in special categories in web sites. The other reason is that more detailed information can be provided from same web site in comparison to the newspaper pages of the news media. Because searching was planned to conduct from internet archives of the newspapers the most popular five Turkish newspapers throughout the country were chosen from Alexa (www.alexa.com) which measures site traffic on the Internet. These newspapers are Hürriyet Newspaper (6. rank), Milliyet Newspaper (9. rank), Sabah Newspaper (17. rank),

Newspaper Habertürk (19. rank) and Vatan Newspaper (33. rank) according to their ranks respectively.

In order to determine number of news, search engines were used newspapers' sites by using *nanotechnology* as a keyword. The concept of nanotechnology is used to determine applications and methods realized in a molecular scale [14], thus be the first concept in content analysis in literature. Starting from the literature searching in these study 12 categories describing content theme/frames and 4 categories describing news tone were used. News are coded as *science and technology policy, scientific discoveries or projects, education, personal, science fiction and popular culture, social implications and risks of nanotechnology, globalization, business story, funding of nanotechnology, visionary & futuristic, human enhancement/medical applications, patents & marketing and PR of nano-products, public interest/trade group activities, economic / structural / scientific viability of nano* and *short historiographies* in content theme/frames. News tone categories are determined as *positive, negative, mix* and *neutral*.

In the study there are 3 research focuses: 1) The rate of attention and interest to the Nanotechnology, 2) Choices of news frames and location of the nanotechnology in newspapers, 3) The ratio of representing news to the audience in positive/negative/neutral tones. These subjects are prominent in content analysis about nanotechnology in literature [8]. In the phase of searching media news it was observed that news related to scientific improvements and discoveries were considerably in large numbers. In addition nanotechnological improvements in a national scale and Turkish scientists' projects national and international area were seen more frequently. In order to examine whether these hypotheses are correct or not analyzing global and national frames in every content theme was planned. According to these observations research questions and hypotheses related to contents were determined.

RQ1: How frequency of news related to nanotechnology has been changed by years in Turkish media?

RQ2: Which frames have been preferred in news related to nanotechnology in Turkish media?

RQ3: What have the rates of global/national highlights in dominant frame placing in the first three orders?

RQ4: Which tone has nanotechnology been given to the audiences in Turkish media?

H1: In Turkish media frequency of nanotechnology news have risen by years.

H2: In Turkish media "scientific discoveries or projects" is the dominant frame.

H3: In the first three content theme determined as dominant frame national emphasis was dominant.

H4: In the first three content theme determined as dominant frame dominant tone is positive.

V. FINDINGS AND DISCUSSION

A. Number of Nanotechnology and Distribution by Years in Turkish Media

In the study after browsing keyword nanotechnology in web archives of newspapers irrelevant news or ads were eliminate. In archive browsing especially news dated 2010 were also eliminated because of avoiding a deviation in distribution of news by years. In addition because missing data were determined before 2005 while archive searching, all of the news between 2005 and 2009 were included and from 5 national newspaper archives total 414 news were collected as universe of the analysis. All news was coded according to the content theme / frame categories determined and adapted from content analyses in literature. In Table I and II analysis of news according to years and news categories are given.

Distribution of total 414 nanotechnology news in five national newspapers with the highest circulation between 2005 and 2009 were in Turkey; in Hürriyet Newspaper 191 news, in Milliyet Newspaper 134 news, in Sabah Newspaper 31 news, in Newspaper Habertürk 49 news, in Vatan Newspaper 9 news. As for distribution by years, the highest number was seen in 2009 with 138 nanotechnology news and increasing rate was determined as 5.7%. It is also seen that there is not systematic increase in rates according to newspapers by years.

Distribution according to news categories shows division and distribution made by editors according to the category that news will be published (See Table II). Distribution seen in the table demonstrates editors' choices according to audiences related to categories. News categories are accepted between framing mechanisms created to shaping public attitudes. Such framing mechanism provides not only content and meaning of news but also ways of perceptions of reporters and editors [13]. In literature it is seen that news categories were not examined or evaluated in general context. For example in Stephens' study which news contents between 1988 and 2004 were examined arrangement of categories were as general news, business news and news channels [16]. In Turkish media it is seen that nanotechnology news are mostly place in categories of economy (23.91%), science and technology (17.63%), actual (12.31%), life (12.07%) and national (36%). Placing news related to nanotechnology rather in category of economy indicates that technology was considered economic aspect instead of scientific character. Distribution rates according to the categories are confirmed H1 hypothesis. This proportional distribution also gives an idea related to distribution of the frames about presenting and rates of dominant news frames.

B. Distribution of Nanotechnology News According to Content Theme / Frame Categories in Turkish Media

In news media and other public communication media nanotechnologies were considered an intersection point of all subjects including environment, human health, scientific discoveries and technological innovation [35]. From this view

TABLE I
NUMBER OF NEWS AND DISTRIBUTION BY YEARS (N = 414)

Range of Years	Hürriyet Newspaper	Milliyet Newspaper	Sabah Newspaper	Newspaper Habertürk	Vatan Newspaper	Total (N)	%
2009	43	54	19	19	3	138	33.33
2008	41	42	3	20		106	25.62
2007	37	20	2	10	2	71	17.15
2006	42	11	2	-	1	56	13.52
2005	28	7	5	-	3	43	10.38
TOTAL	191	134	31	49	9	414	100%

N = Number of news. % = Percent.

news publishing related to nanotechnology was evaluated according to these subjects. Laing's survey examining Canadian and American media representing of news about nanotechnology is mainly in three themes. Noticeable frames in 86% of examined news are: profiling new technologies, societal risk/benefit discussion, business and market news. Except of these three main frames, other frames and their rates are profiles of institutes or facilities (8%), economic impact (5%), regulatory, legal and/or patent issues (1%) [8]. In Stephens' content analysis on America media the first five

TABLE II
DISTRIBUTION OF NEWS ACCORDING TO NEWS CATEGORIES (N = 414)

Newspapers	Hürriyet Newspaper	Milliyet Newspaper	Sabah Newspaper	Newspaper Habertürk	Vatan Newspaper	Total (N)	%
Economy	26	47	6	17	3	99	23.91
Science	52	7		14		73	17.63
Actual	21	16	10	2	2	51	12.31
Life	13	27	7	3		50	12.07
National	32	4				36	8.23
Global	12	6	1			19	4.58
Columnist	12				3	15	3.62
Health	7	1	3	4		15	3.62
Weekend	10	4				14	3.39
Other		6	3	3		12	2.89
Education	4	4				8	1.93
Sectoral		2		6		8	1.93
Magazine	2	4	1			7	1.69
Local		5				5	1.21
Politics		1			1	2	0.99
TOTAL	191	134	31	49	9	414	100%

N = Number of news. % = Percent.

dominant frames are scientific discoveries or projects (%27.3), social implications and risks (ELSI) (16.95%), business story (10.63%), Funding of nano (9.20%), celebratory (6.61%) [5]. Research findings related to

dominant frames are quite similar according to these two researches.

Findings of the Kjærgaard's research based on Stephens' analysis on Danish media showed a different framing mechanism in European media compared to American media. According to results in Denmark main news frames in the first three orders are science and technology policy (%19.6), scientific discoveries or projects (17.6%), education (%14.4). Other frames are personal (12%), science fiction and popular culture (6.4%), social implications and risks of nanotechnology (6%), globalization (5.2%), business story (5.2%), funding of nanotechnology (4.8%) following respectively [36]. While scientific discoveries, projects and social consequences of these were prominent in American media, in Danish media scientific discoveries and explores were come after news related to legal regulations.

In Turkish media the most prominent frame is *scientific discoveries or projects* with 18.86% and shows similarity with the American media (See Table III). This result is confirmed H2 hypothesis. After this, Activities of commercial groups, practices (16.69%), vision – futuristic (15.47%), business stories (10.64%) and education (9.44%) are following frames. According to these results it can be also said that a similarity between distribution and framing rates by news categories. Nanotechnology in Turkish media was represented through its economic character in addition to scientific importance and news related to production of nanotechnologic products, products and production technologies were considered seriously. Third frame vision – futuristic (15.47%) focused on benefits of nanotechnology and the frame of Business histories emphasized histories about consumption processes of nanotechnologic products. The other noticeable point is that dominant frames related to legal regulations and social impacts – risks in both American and European media placed at end of the order of frames. In Turkish media importance given to legal regulations and social impacts – risks is considerably low. According to the analysis effects of the nanotechnology on economy and business were considered more important than social effects and risks.

C. Distribution of Nanotechnology News According to News Tone and Global/National Frame Categories in Turkish Media

In Turkish media news tone was positive with the rate of 85.99%, negative with the rate of 2.65%, mix with the rate of 7.49% and neutral with the rate of 3.87%. These results showed that in Turkish media nanotechnology were considered mostly in a positive way. In Table IV, a comparison of news tone and framing categories is showed. Findings are not differed from the general status and it is seen that the content in the dominant frames in the first three orders was represented with a positive tone. This result confirms H3 hypothesis. In Friedman's research on US and UK newspapers between 2000 and 2004 total 121 news were evaluated in the context of nanotechnology agenda and 65 *negative*, 46 *positive*, 54 *neutral* and 36 *mixed* (both negative and positive

TABLE III
DISTRIBUTION OF NEWS ACCORDING TO FRAME CATEGORIES AND NEW TONES (N = 414)

News Papers	Hürriyet Newspaper	Milliyet Newspaper	Sabah Newspaper	Newspaper Habertürk	Yatan Newspaper	Total	%
Scientific discoveries or projects	38	19	6	15		78	18.86
Public interest / trade group activities, nano-products	36	19	4	7	3	69	16.69
Visionary, Futuristic	35	18	5	5	1	64	15.47
Business story	4	24	6	7	3	44	10.64
Education	17	17		4	1	39	9.44
Personal	18	13	1	2		34	8.23
Economic /structural /scientific viability of nano	10	11	4	5	1	31	7.49
Human enhancement /medical applications	10	3	1	2		16	3.88
Funding of nanotechnology	5	4	1			10	2.43
Short historiography	6	2	2			10	2.43
Science fiction and popular culture	3	1	1			5	1.21
Patents & marketing and PR activities	3	1		1		5	1.21
Science and technology policy	3	1				4	0.99
Cooperation, protocols, programs	2	1		1		4	0.99
Social implications and risks of nanotechnology	1					1	0.04
TOTAL	191	134	31	49	9	414	100%

N = Number of news. % = Percent.

expressions) news were seen [37]. Also in the results of the media content research on German printed media between 2000 and 2007 conducted by Federal Institute for Risk Assessment (BfR) nanotechnology was not represented as a risk technology in media and positive content rate was 70% were showed [17]. References as a news tone direct at benefits of the nanotechnology rather than risks regarding ethical and social effects of nanotechnology. In the study conducted by Stephens frames directed to determining news tone were investigated in categories of Not Applicable, Benefits Outweigh Risks, Risks Outweigh Benefits, Risks/Benefits Need to Be Weighed But Unclear if B < or > R, Technical Limits to Progress, Not Limits Associated with ELSIs. In the study it is mentioned that news mainly focused on the benefits of the nanotechnology as similar to results of other studies [8],[13],[16].

New categories of frame were evaluated relating to the representing frames about Nanotechnology news in Turkish media. Because expressions such as Turk, Turkish, and Turkey were determined in the evaluated news these categories that are not mentioned in literature was examined. The category with name *National* includes Turkish scientists,

research centers in Turkey, realized scientific discoveries and projects in Turkey, Turkish firms, visions and future plans towards Turkey and is only based on developments in national scale. The category with name *Global* expresses all developments and advancements around the world and news contents that not contain national emphasizes. Frames related to these categories are shown in Table IV with concepts of Global (G) and National (T). According to this in all framing categories national and global emphasis were made at the rates of 70.98% and 29.2% respectively. In addition, in the first three framing categories contents in which national emphasis was made is almost double compared to global emphasis (see Table IV). According to findings it can be said that H4 hypothesis was approved. The most important determination that can be mentioned for interpreting results that as reporting of the nanotechnological advances Turkish media provided mainly news about successes in Turkey to Turkish people. Turkish media has been attempting to shape public opinion with a positive attributes and to gain public support for the developments of nanotechnological advancements in Turkey by representing contents with an economic and business characteristics.

From this aspect media contents as a component directing public perceptions help in creating positive attitudes in public by using positive content. For example according to the results of the Project on Emerging Nanotechnologies in 2008 Americans who is informed about nanotechnology generally believes that nanotechnology have benefits rather than risks [25]. In addition media publications lead to emerge an optimist portray not only for present but also future. Gaskell made similar determinations related to opinions about nanotechnology and life styles in his research conducted in America and more than 15 European country. In the study which opinions towards the function of nanotechnology in rising life standards in the next 20 years were investigated he determined that people generally optimistic related to technology [4]. Weaver et al. claimed that positive attitude towards nanotechnology has become clear through emphasizing benefits other than risks [35]. According to Simon et al. when awareness and attitude towards risk is low fears about threats to the humanity due to nanotechnology can be removed easily with news [38]. In Turkey any study evaluating perceptions and attitudes about nanotechnology has conducted yet. As positive situation appearing are considered it can be claimed that Turkish public opinion will be focused on benefits of nanotechnology rather than risks. Certainly for the valuation of this assumption there is need more studies.

VI. CONCLUSION

Throughout the world including countries funding and providing allocation for nanotechnological research practices in spite of the positive contents of the media regarding nanotechnology at global scale number of news about nanotechnology is not high enough. Even studies concluding that number of news about nanotechnology have risen it is

TABLE IV
 DISTRIBUTION OF NEWS ACCORDING TO FRAME CATEGORIES, NEW TONES AND GLOBAL/NATIONAL FRAMES (N = 414)

Range of Frame Categories and Tones	POSITIVE		NEGATIVE		MIX		NEUTRAL		TOTAL (N)	
	G	T	G	T	G	T	G	T	G	T
Global (G) National (T)										
Scientific discoveries or projects	26	52							26	52
Public interest /trade group activities, nano-products	23	43				2		1	23	46
Visionary, Futuristic	18	38	2	2	3	3	1		24	43
Business story	3	33			1	1	1	5	5	39
Education	2	35					1	1	2	37
Personal	2	27	1				2	1	3	30
Economic /structural /scientific viability of nano	6	16		1	1	7			7	24
Human enhancement /medical applications	7	1	2		5			1	14	2
Funding of nano technology	2	2		1		2	2		4	5
Short historiography	5	1			1		2	1	8	2
Science fiction and popular culture	2	2				1			2	3
Patents & marketing and PR activities		3		1		1				5
Science and technology policy	1	2		1					1	3
Cooperation, protocols, programs		3								3
Social implications and risks of nano-technology	1								1	
Total (G&T)	98	258	5	6	11	20	6	10	120	294
TOTAL	85.99%		2.65%		7.49%		3.87%		100%	

N = Number of news. % = Percent.

claimed that nanotechnology has not the leading agenda topic yet. Scheufele mentioned that in the last few years' news were provided news only for general public but also reminded that Project on Emerging Nanotechnologies reported that 3-4 nanotechnologic products were put on the market in every week. According to Scheufele individuals are using nanotechnology in daily activities without realizing scientific knowledge and attributes of the technology [20]. Because of the difference between consumption of products and the rate of technological awareness in the future while negative consequences were faced positive attitudes to the technology can be reversed. Media attention on these possibilities and stories might lead to the perception towards nanotechnology as a threat affecting many fields rather than being a useful and friendly technology [38]. This situation is also possible for Turkey. Because there are few products in the national market such threats have not been moved to the agenda for now. But in Turkey if it is supposed that nanotechnologic products will

become widespread national studies related to public perceptions and also consumption tendencies and perceptions will need.

REFERENCES

- [1] T. C. Devezas, H. A. Linstone and J.S. Santos Humberto, "The Growth Dynamics of The Internet and The Long Wave Theory". *Technological Forecasting & Social Change*, vol. 72, 2005, pp. 913-935.
- [2] S. Arnaldi, "Converging Technologies in The Italian Daily Press 2002-2006: Preliminary Results of An Ongoing Research Project". *Innovation: The European Journal of Social Science Research*, Vol.21/1, 2008, pp. 87-94.
- [3] J. Canton, "The Impact of Convergent Technologies and the Future of Business and The Economy". in *Converging Technologies For Improving Human Performance - Nanotechnology, Biotechnology, Information Technology and Cognitive Science*. M Roco & W.S. Bainbridge, Eds. National Science Foundation Report. USA: World Technology Evaluation Center (WTEC) Inc., 2002, pp. 61-68.
- [4] G. Gaskell, T.T. Eyck, J. Jackson, and G. Veltri, "Imagining nanotechnology: Cultural support for technological innovation in Europe and the United States". *Public Understanding Science*. Vol.14, 2005, pp. 81-90.
- [5] L. F. Stephens, "News Narratives about Nano S&T in Major U.S. and Non-U.S. Newspapers", *Science Communication*, vol. 27, 2005, pp. 175-199.
- [6] "Venture Capital Funding of Nanotechnology", *ObservatoryNano Report*, 2009, pp. 1-14. http://www.observatorynano.eu/project/file_system/files/Economics_VentureCapital_fullversion.pdf.
- [7] RNCOS Nanotechnology Market Forecast Report 2013, March 2010. <http://www.ncos.com/Report/IM185.htm>.
- [8] A. Laing, "A report on Canadian and American news media coverage of nanotechnology issues", pp. 88-98. www.nanotechproject.org/file_download/25.
- [9] "Preparing for our future: Developing a common strategy for key enabling technologies in the EU", *Commission of the European Communities Report*, 2009, http://ec.europa.eu/enterprise/sectors/ict/files/communication_key_enabling_technologies_sec1257_en.pdf.
- [10] J. Macoubrie, "Informed Public Perceptions of Nanotechnology and Trust in Government", *The Project on Emerging Nanotechnologies*, the Woodrow Wilson International Center for Scholars, 2005. http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Nanotechnologies/Nanotech_0905.pdf.
- [11] "EU-funded study: nanotechnology decision-making needs greater public involvement", 2009, http://cordis.europa.eu/fetch?CALLER=EN_NEWS&ACTION=D&DOC=31&CAT=NEWS&QUERY=0127b81d1ba:e4b2:7cbdeb35&RCN=31300.
- [12] T. Listerman, "Framing of science issues in opinion-leading news: international comparison of biotechnology issue coverage", *Public Understanding of Science*, vol.19, 2010, pp. 5-15.
- [13] A. Petersen, A. Anderson, S. Allan and C. Wilkinson, "Opening the black box: scientists' views on the role of the news media in the nanotechnology debate", *Public Understanding of Science*, 2009, vol.18, pp. 512-530.
- [14] B. Faber, "Popularizing Nanoscience: The Public Rhetoric of Nanotechnology, 1986-1999", *Technical Communication Quarterly*, 2009, vol. 15, no.2, pp.141-169.
- [15] T. Sheetz, J. Vidal, T. D. Pearson, K. Lozano, "Nanotechnology: Awareness and societal concerns", *Technology in Society*, 2005, vol. 27, pp. 329-345.
- [16] L. F. Stephens, "News Narratives about Nano S&T in Major U.S. and Non-U.S. Newspapers", *Science Communication*, vol. 27, 2005, pp. 175-199.
- [17] Federal Institute for Risk Assessment (BfR) Report, "Positive image of nanotechnology in the media", 2008, <http://www.bfr.bund.de/cd/26907>.
- [18] M. C. Nisbet and C. Money, "Science and Society: Framing Science", *Science*, vol. 316, 2007, pp. 56.
- [19] M. C. Nisbet, D. Brossard and A. Kroepsch, "Framing Science: The Stem Cell Controversy in an Age of Press/Politics", *The Harvard International Journal of Press/Politics*, 2003, vol.8, pp. 36-70.
- [20] "Q&A: Professor provides analysis of work on nanotechnology research", 2008, <http://www.news.wisc.edu/16060>.
- [21] M. D. Cobb and J. Macoubrie, "Public perceptions about nanotechnology: Risks, benefits and trust", *Journal of Nanoparticle Research*, 2004, vol. 6, pp. 395-405.
- [22] D. A. Scheufele and B. V. Lewenstein, "The public and nanotechnology: How citizens make sense of emerging Technologies", *Journal of Nanoparticle Research*, 2005, vol.7, pp. 659-667.
- [23] "Nanoscience and nanotechnologies: opportunities and uncertainties", *The Royal Society & The Royal Academy of Engineering Report*, 2004, <http://www.cst.gov.uk/business/files/nano-report-2004-fin.pdf>, p. xi.
- [24] Y. Fujita, "Perception of nanotechnology among general public in Japan", *NRI Nanotechnology and Public Survey Project, Asia Pacific Nanotech Weekly*, 2006, no.4, <http://www.nanoworld.jp/apnw/articles/library4/pdf/4-6.pdf>.
- [25] "Awareness of and Attitudes Toward Nanotechnology and Synthetic Biology", *Project On Emerging Nanotechnologies, The Woodrow Wilson International Center For Scholars*, 2008, www.nanotechproject.org/process/assets/files/7040/final-synbioreport.pdf.
- [26] R. Entman, "Framing: Toward Clarification of A Fractured Paradigm" *Journal of Communication*, 1993, vol:43, no:4, pp. 51-58.
- [27] M. McCombs, "A Look at Agenda-Setting Theory: Past, Present and Future", *Journalism Studies*, 2005, vol:6, no:4, pp. 543-557.
- [28] J. N. Bostick, "Second-Level Agenda-Setting and Political Advertising: A Content Analysis of the Framing Dimensions by The 2004 Presidential Candidates", *A Thesis in Mass Communications, The Graduate Faculty of Texas Tech University*, May 2005, http://etd.lib.ttu.edu/theses/available/etd-05052005-202937/unrestricted/thesis_merged.pdf, p. 15.
- [29] K. Hallahan, "Seven Models of Framing: Implications for Public Relations", *Journal of Public Relations Research*, 1999, vol:11, no:3, pp. 205-242.
- [30] A. Yagade and D. M. Dozier, "The Media Agenda Setting Effects of Concrete Versus Abstract Issues", *Journalism Quarterly*, 1990, vol:67, pp. 3-10.
- [31] S. Ghanem, "Filling In The Tapestry: The Second Level Of Agenda Setting", in *Communication And Democracy: Exploring The Intellectual Frontiers in Agenda-Setting Theory*, M. McCombs, D. Shaw, D. Weaver, Eds. Mahwah, NewJersey: Lawrence Erlbaum Associates, 1997, pp. 3-14.
- [32] C. Lee And D. A. Scheufele, "The Influence of Knowledge And Reference Toward Scientific Authority: A Media Effects Model For Public Attitudes Toward Nanotechnology", *J&MC Quarterly*, vol. 83, no. 4, 2006, pp. 819-834.
- [33] A. I. Arias, "The Media Coverage of Nanotechnology", *NNIN REU Research Accomplishments*, 2004, pp. 18-19.
- [34] Z. Pan and G. M. Kosicki, "Framing analysis: An approach to news discourse", *Political Communication*, vol.10, 1993, pp. 55-75.
- [35] D. A. Weaver, E. Lively and B. Bimber, "Searching for a Frame: News Media Tell the Story of Technological Progress, Risk, and Regulation", *Science Communication*, vol.31, 2009, pp: 139-166.
- [36] R. S. Kjærgaard, "Making a small country count: nanotechnology in Danish newspapers from 1996 to 2006", *Public Understanding of Science*, vol.19, no.1, 2010, pp. 80-97.
- [37] S.M. Friedman and B.P. Ego, "Nanotechnology: Risk and the Media", *IEEE Technology and Society Magazine*, 2005, pp. 5-11.
- [38] J. Simons, R. Zimmer, C. Vierboom, I. Ha'rlen, R. Hertel and G. F. Bøl, "The slings and arrows of communication on nanotechnology", *Journal of Nanopart Res.*, 2009, vol. 11, pp. 1555-1571.

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