A Study on the South Korean Media toward Science and Technology of North Korea in the Era of Kim Jong-Un:
Based on the Analysis of Framing and Information Source

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Abstract   In traditional studies on North Korea, conservative media in South Korea generally report and have an attitude toward anti-North Korea. It is a similar context as South Korea's conservatives view the U.S. and Japan more closely and positively than North Korea. This study is about how the reporting frames and information sources on North Korean science and technology in South Korea's conservative and progressive media differ and show trends. As a result of analyzing the reporting frame on North Korean science and technology by conservative and progressive media, progressive media showed similar trends or slightly positive responses to North Korean science and technology. But the reanalyzed result after dividing it into conservative and progressive governments, the opposite result came out. In the conservative government, the progressive media dealt with very positive aspects of North Korea's science and technology, and in the progressive government, there was a clear tendency to report negative rather than positive. What can be inferred from this is that the progressive media of South Korea had at least quite different directions of the progressive government in dealing with North Korean science and technology, but rather close to anti-North Korea. It is difficult to reach a hasty conclusion because this study has not dealt with all the press and only 10 years after the Kim Jong-Un regime. Nevertheless, this study may provide implications in that it is the first study to analyze how South Korean conservative and progressive media frame North Korean science and technology.

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I. Introduction

The relations between South and North Korea reflect not only national politics but international politics as well. Since Moon Jae-In's government, relations with North Korea (hereinafter referred to as "NK") have changed so much that it is incompatible with the last two governments, Lee Myung-Bak and Park Geun-Hye governments. There was also a movement in the field of inter-Korean science and technology (hereinafter referred to as "S&T") exchange and cooperation. Specifically, mutual understanding and cooperation on basic sciences such as Geology and Bioscience were emphasized. In addition, railway cooperation received attention due to expectations for reunification, and there were discussions on related technologies. However, the peace negotiations between the U.S. and North Korea ended in 2019 after the U.S.-North Korea Summit in Hanoi, and discussions on inter-Korean science and technology cooperation were officially suspended.

Kang (2020) analyzed changes in NK, focusing on science and technology. NK values S&T and affects not only the national defense but also the economy, society, and cultures as a whole. Since 2018, North Korea has established a new strategy to end simultaneously promoting nuclear development and economic development to maintain the system and focus on building a socialist economy. On realizing this, it has decided to focus on science and technology development. (Byun, 2018). What can be inferred from this is that the Kim Jong-Un regime inherited the science and technology-oriented line of the Kim Il-sung and Kim Jong-Il eras and continued to emphasize the development of science and technology of the previous regime despite changes in the regime. On the other hand, this is important how South Korean (hereafter referred to as "SK") society perceives NK's science and technology. There is also a need to study where this perception originated. According to a survey conducted by the Korea Institute for National Unification in 2020, South Korean society had a high negative perception of NK and viewed them as dangerous or threatening beings. However, South Korean society still wants exchanges and cooperation with NK as much as securing military safety against NK's nuclear weapons (Lee et al., 2020).

This study starts with the awareness of the public perception of inter-Korean S&T cooperation. The following survey and analysis were conducted for the two leading SK newspapers, Dong-A Ilbo and Hankyoreh. Unlike the U.S. media, Korean media ostensibly provided the necessary information to political parties and defended their interests. Nevertheless, in many studies, it is discussed in the existing literature that the Chosun Ilbo and Dong-A Ilbo have strongly conservative views, and the Hankyoreh and

the Kyunghyang Shinmun have progressive solid views. In particular, Ha and Lee (2012) conducted a study on the actual life condition of people in North Korea by using framing methods in South Korean newspaper reporting, and it clearly shows the Dong-A Ilbo is a conservative paper and the Hankyoreh is a progressive paper, showing a clear political tendency. In this context, conservatism is a political ideology that tends to maintain current stability through minimal reform with a principle of advocating the old rather than new changes, and the opposite tendency is progressivism. Unlike conservatism, which slowly pursues change for stability, liberalism is an idea that pursues fundamental change enough to be called a revolution.

First, it examines the trends of South Korean media on North Korea's science and technology and the differences between conservative and progressive media. Second, it analyzes what framing was made through a new analysis frame on North Korean science and technology reporting. Third, it analyses the status of information sources on North Korea's science and technology and anonymous informants. Therefore, this study established the following research questions.

Research Question 1.
    How does South Korean Media deal with "Science and Technology in North Korea" and what are the quantitative characteristics?

Research Question 2.
    What is the difference between reporting frames and information sources on science and technology in North Korea in South Korean Media?

Research Question 3.
    What is the difference between reporting frames and information sources on science and technology in North Korea according to conservative and progressive governments?

2. Theoretical Discussion

2.1. Science & Technology in North Korea
    In North Korea, politics is a hereditary regime in the socialist system, which is centered on a supreme leader and operated by three organizations: the party, the government, and the military. The economy is a planned economy based on socialism, but due to long economic sanctions, marketization has recently spread by recognizing personal ownership.
    In terms of science and technology, the party central committee's science education department prepares a basic policy direction, and when it is decided

at the Labor Party Conference, the National Planning Committee Science and Technology Planning Office adjusts it to harmonize with economic policy (Park, 2002).

In every New Year's address, Kim Jong-un has shown a higher priority on S&T than other fields to seek economic development by focusing on S&T capabilities. At the 8th Party Conference held in January 2021, North Korea announced a new five-year economic development plan and said that science and technology is "attracting more socialism and it is the driving force for the development of the national economy" (Ministry of Unification, 2021).

Lee & Kim (2015) analyzed that the science and technology policy of the Kim Jong-un era reflects industrial sites and demand for people's livelihoods and reorganizes the R&D system under the National Institute of Science, which marks its 60th anniversary, focusing on cutting-edge and core technologies. Since Kim Jong-un took power, investment in the science and technology sector has continued to expand, and "the human resources of science and technology" and "integration of science and technology and production" have been promoted (Yu & Kim, 2020).

However, due to strong economic sanctions by the international community in 2012, international-level science and technology's openness and convergence research are suffering ups and downs.

Byun (2021) evaluated the 8th conference and set a goal that greatly considered reality but argued that it is impossible to ease or lift sanctions against North Korea within a short period of time and that it is difficult to expect a surge in science and technology capabilities. Nevertheless, inter-Korean science and technology can cooperate on a different level if the strained phase of international politics is resolved in the future. Therefore, there is a need to maintain and strengthen the foundation and networking for inter-Korean cooperation in the field of science and technology.

Since the principle of demand is important for inter-Korean cooperation, it seems reasonable to break through the inter-Korean crunch in the field of science and technology that North Korea prioritizes. Reflecting this, Song (2018) argues that inter-Korean exchanges and cooperation through science and technology can be used as a major means of harmony. Science and technology cooperation between the two Koreas can be exchanged, focusing on basic research such as volcanoes, earthquakes, climate and environment, and ecosystems, and can then be reviewed for convergence research and international technology commercialization (Song et al., 2018). Basically, basic (science) research is conducted through public R&D. In other words, public support and social consensus are important due to the publicity and public interest in research resources. Therefore, the degree of public understanding and interest in North Korea's science and technology is bound to be greatly influenced by the media. In classical diplomacy, the attitude or image of a country or group other than its

own country is usually revealed by the diplomatic position of that country. Since North Korea's attitude and image depend on the position of the South Korean regime, research on it is essential because the media reflects it and forms public opinion.

2.2. Framing in Media research and its application

SMCRE is one of the traditional communication theories. S represents a sender, M represents a message, C represents a channel, R represents a receiver, and E represents an effect. The key points are 'Who,' 'Say What,' 'In Which Channel,' 'To Who,' and 'With What Effect' (Laswell, 1948; Kim Ho-seop et al., 2011; Choi Choong-ik et al., 2016). In this study, it focuses on information sources as "sender (s)," North Korea's science and technology as "message (M)," and South Korean media as "channel (C)." In particular, it is to analyze the frames and information sources of articles expressed in the South Korean media during the era of Kim Jong-Un in North Korea. The media frame exerts a certain effect (E) on the event or information to the receiver (R). Many studies on media frame analysis have been conducted and are being developed until recently, and this is because it is becoming a research question of how the intended message is reflected in media articles or in audiences.

The media basically is framing the issues that need to be dealt with. The frame is a concept initiated by Bateson (1972), explained as a "context boundary," and Goffman (1974) explains that the frame is a theoretical concept constructed to elaborately develop discussions on situations that define social behavior and the way the behavior is organized. One of the characteristics of a frame study is to clarify the practical implications of the research results and provide practical guidelines accordingly (Lee, 2000). The news frame reflects the strategies of various political groups to carry out their arguments and interests (Bennett, 1996; Entman, 2004).

Chung and Druckman (2007) define framing as meaning that people develop a specific conceptualization of an issue or reorient their thoughts on the issue and explain that the effect is realized by a mediating process or mediator. Many scholars can understand that the media gives meaning by selecting, emphasizing, or excluding certain aspects of the matter through framing rather than reflecting reality as it is (Entman, 1993; Gamson & Modigliani, 1987; Gitlin, 1980; Iyengar, 1991, Tuchman, 1978).

Kim & Lee (2002) classified the characteristic frames of news related to North Korea into hostile and amicable news framing. In this, an amicable framing was defined as a case in which homogeneity, positive feelings, or support, optimism, and advocacy were strongly expressed in North Korea-related issues. Choi & Ha (2016) analyzed the tone of the unification issue reporting as a framing of "positive," "neutral," and "negative," and as a result of the study, South Korean newspapers generally showed a "neutral" and "positive" tone.

2.3. Information source of news reporting on North Korea

The news on NK is restricted from direct coverage and reporting due to the distinct characteristics of NK's system. This restraint applies not only to the national media but to media overseas. In addition to the current situation in which NK is subject to severe economic sanctions by the United Nations and neighboring countries, and also due to COVID-19, direct coverage is impossible. Kim (2011) indicates that articles that the reporter did not directly cover appear in a lot of passive, indirect quotes such as "It is known to be ~" and "It is said to be ~." Media power arises from accurate coverage and factual reporting. This is because the media checks the regime and power and is referred to as the fourth part of power (Yoo & Lee, 1994), and its power is powerful in a democratic society. Therefore, anonymous reporting cannot be justified even in NK, but there are also positive aspects to them. Anonymous reporting contributes to the monitoring of the power of the media, and to the continuous relations with the informant as a means of protecting the source of information source (Duffy & Freeman, 2011).

Previous studies have dealt with the negative consequences and effects of anonymous processing of information sources. Anonymous reporting can be used to guarantee the public interest, but if anonymous reporting is abused, it undermines the credibility of the media and weakens the reporters'(Park, 2004; Park, 2005; Lee & Lee, 2014; Lee & Kim, 2000; Itule & Anderson, 2003; Kovach & Rosenstiel, 2001). Anonymous reporting becomes an issue even with reporters. According to Cho & Yang (2006), 80.5% of reporters recognize that there is much anonymous reporting from media in SK, and reporters utilize anonymous sources for reasons such as "protection of informant," "requests from informants," and "prevention of lawsuits." Lee & Cho (2017) emphasize that in order to reduce the negative impact of anonymous reporting, it is necessary to make efforts such as revealing the real name of the reporter or revealing reasons why anonymity is inevitable.

In 2014, reporters from NK who attended the reunion of separated families pointed out that "(SK's) Media needs to loosen up, so it could help to have such a reunion. The reporting in SK is too much." "The media in SK is way too much; it needs to be written to help to have people exchanges" (Im, 2014: 94). Moreover, on those reporting on NK, most of the information sources are mentioned as unknown and processed anonymously. According to the study, North Korea is made as "Public Enemy" by Jung & Kim (2017) argue that frequently mentioned informants in real name are authorities from NK, the U.S., and SK. Also, there is a high possibility that those anonymous reportings come from the National Intelligence Services (NIS). In particular, later known to be

false news were mostly anonymous and often revealed as false information by the North Korean real named informant.

Shim (2004) analyzes the sources of North Korean hunger-related reports in the U.S. media, where the U.S. administrative officials marked the highest number (22.5% of the Washington Post, 22.1% of the New York Times). The key point here is that other categories (19.5% of the Washington Post, 18.0% of the New York Times) were quite high, even excluding figures from other sources like the U.S., SK, and NK. It has not been found whether it is anonymous or due to reports by other sources. In this study, the need to further subdivide the classification of information sources is raised.

3. Research subjects and Method

3.1 Analysis subjects and unit

For this study, two national newspapers, Dong-A Ilbo and Hankyoreh, were selected as subjects to be analyzed. These newspapers have been widely used as progressive and conservative papers in previous studies in terms of distinct differences in tone or representative political orientation. (Kim, 2018; Park, 2015; Choi, 2018). In general, studies on North Korea-related reportings showed a tendency to classify the Chosun Ilbo and Dong-A Ilbo as conservative newspapers and the Kyunghyang Newspaper and Hankyoreh as progressive newspapers (Kim & Noh, 2011; Kim & Kim; 2015; Sohn & Hong, 2019; Yang, 2016; Lee & Sohn, 2011; Ha & Lee, 2012). In this study, Dong-A Ilbo was defined as a conservative medium and Hankyoreh as a progressive medium.

The analysis unit is the entire section of individual articles that are reported in the newspaper. Articles related to science and technology in North Korea refer to reports that expressed in political, social, military, and economic issues as science and technology in North Korea discussed in North and South Korea. In the first analysis, quantitative analysis was conducted on the entire selected sample. In the second analysis, for source and place analysis, news frame analysis, and information source analysis according to operational definition, photo articles, duplicated articles, introduction of new book/art/performance, and keywords were excluded from analysis subjects.

3.2 Time frame and scope

The time frame for this analysis was set by the Park Geun-hye and Moon Jae-in governments, which have different views on the North Korea policy during Kim Jong-Un's reign. On December 30[th,] 2011, Kim Jong-Un officially took power over the NK after his father Kim Jong-Il's death. The Park Geun-hye government was officially inaugurated on February 25th, 2013, and the Moon Jae-in government on May 10th, 2017. In this study, the time frame for analysis

was set from December 30th, 2011 to August 30th 2021, which focuses on Kim Jong-Un's ruling period. It also overlaps some of Lee Myung-Bak's government period at some time.

For the newspaper articles search, the news big data analysis service from the Korea Press Foundation, called BIG KINDS, was used, and it provides services such as systems for collection, analysis and storage to the nation's largest article database, including comprehensive daily newspapers, economic journals, regional daily newspapers, and broadcasters. In accordance with the time frame, North Korea's science and technology were extracted at first, then a second analysis was conducted after selecting an operational definition selection.

3.3 Categories and operational definition

The analysis was divided into two categories. For the first analysis, the entire sample was classified and analyzed by press, period, and page, and additional network and related word analyses were conducted. During the second analysis, the reporting was selected by the operational definition, and then it was subdivided into three categories as follows: North Korea, South Korea, and Overseas. This categorization was based on the source and the location of articles and in order to figure out how the source and the location changed within the reporting on science and technology in North Korea.

Table 1 Classification of source and location of the articles

Category	Contents
North Korea	The source of the article or the place where it took place is 'North Korea'
South Korea	The source of the article or the place where it took place is 'South Korea'
Overseas	The source of the article or the place where it took place is 'Overseas'

As for the second phase, analysis was conducted on the selected articles after setting the news framing as positive, neutral, and negative. The framing was set by collecting similar topic statements based on the written topic statements. A sub-classification system, according to the major classification derived through agreement between coders, was established. This study attempted to extract detailed framings using an inductive method that has the advantage of being able to identify various framings on the issues of the study subject (Kang, 2002). Detailed framing types are as follows in Table 2 below.

Table 1. Analyzing frame

Category	Sub-category	Contents
Positive	Science and technology	Articles on research achievements and people such as natural science, engineering, and industrial technology (including International joint research, cooperation, and meetings)
	Non-scientific technology	Positive articles on politics, economy, society, and culture related to science and technology
Neutral	Simple fact	Articles on delivering facts and information related to science and technology
Negative	Threatening science and technology	Articles focusing on nuclear weapons, hacking (security), and military technology
	Non-scientific technology	Negative articles on politics, economy, society, and culture related to science and technology

In the third phase, the investigation and analysis were conducted by the information sources, followed by North Korea, South Korea, overseas, and anonymous after they were classified and structured, then after it was sub-classified as shown in Table 3 below.

Table 2. Analyzing frame for information source

Category	Sub-category	Contents
North Korea	Kim Jung-Un (Kim Jong Il, Kim Il Sung)	Articles citing the supreme leaders of NK
	Party and Government	Articles citing the party, government, or institutions in NK
	Media	Articles citing newspapers, broadcastings, or websites of NK
	Private Sector	Articles citing private organizations or people in NK
South Korea	Governments	Articles citing the Blue House, the government, or local governments
	National Assembly	Articles citing the National Assembly or its members
	Public and Research Institutes	Articles citing public institutions or research institutes
	Media	Articles citing journals, press, or media outlets
	Civil and social organizations	Articles citing civic groups, NGOs, or social organizations, etc.
	Individuals	Articles citing North Korean defectors or individuals

Overseas	International Organization	Articles citing the United Nations or international organizations
	USA	Articles citing the U.S. administration, media, or institutions
	China	Articles citing the Chinese administration, media, or institutions
	Japan	Articles citing the Japanese administration, media, or institutions
	Europe	Articles citing the European administration, media, or institutions
Anonymous	-	Articles citing unnamed or unmarked

3.4 Reliability between Analysis Methods and Coder

At first, the analysis of related words was conducted by using the service that visualizes highly related keywords based on the analyzed news and connectivity (weighting, keyword frequency) among newspaper, period, and search results provided by BigKind. Among the searched results, those subjects like character, locations, organizations, and keywords that were sorted out from the top 100 analyzed news by connections to each were visualized in network form. Secondly, a single value was assigned for each article using the frame from the framing analysis as described before. The information source was allowed to analyze its binary duplicate response. Lee (2014) defines North Korea-related articles covered by two or more reporters as fair and objective news. Allowing duplicate responses to the information source will show meaningful analysis results.

The coding was progressed by two coders based on continuous discussions during the whole process, and they were trained and educated to increase the accuracy of analysis. Kripendorf's alpha calculation method was used to measure the confidence coefficient. The average reliability of Hankyoreh and Dong-A Ilbo for each item was measured to derive the following result values. The reliability between coders was quite high with 0.865 in the first source and location analysis, 0.820 in the second news frame analysis, and 0.812 in the third information source analysis.

4. Findings

4.1 Results of quantitative analysis on Media reporting

As a result of the 1st round based on the presented method, a total of 321 articles on science and technology in NK were searched, where 151 were from Dong-A and 170 from Hankyoreh. It was found that there were slightly more

articles on science and technology in NK in Hankyoreh than those in Dong-A. In the 2nd round based on the operational definition, a total of 154 articles were sorted, 79 articles were from Dong-A and 75 articles from Hankyoreh.

The annual frequency was shown in Figure 1, followed by 2018 (59 cases, 18.3%), 2013 (49 cases, 15.3%), and 2012 (40 cases, 12.5%). Also, Figure 1 shows this monthly. During May and June in 2018, the report on S&T of NK reached the highest of 22 cases due to Kim Jong-Un's state visit to China and the North Korean delegation's visit to China. Due to the NK's ICBM missile launch in the period between December 2012 and January 2013, the news rapidly increased up to 18 cases. From November to December 2013, the news on the 2nd anniversary of Kim Jung-il's death-related keywords was mentioned many times, and it reached 12 cases.
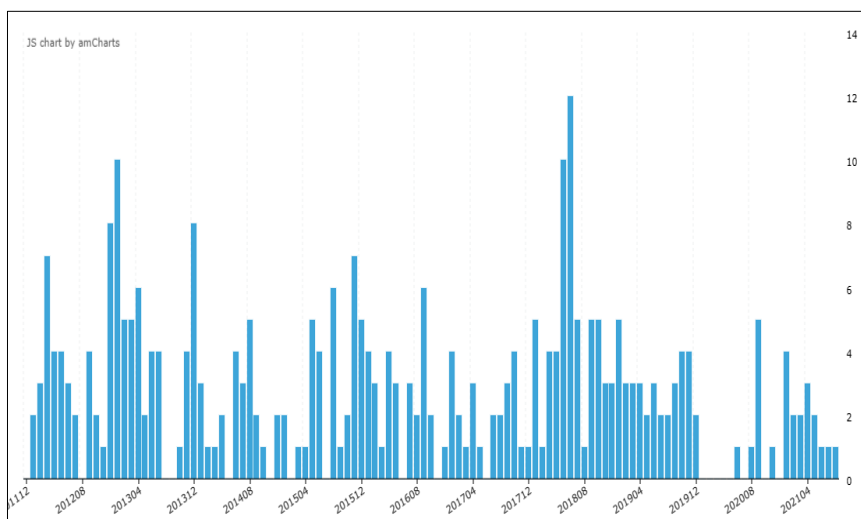

Figure 1. Trend of monthly reporting of related articles

A total of 453 articles were searched by sections, including the overlapping pages registered by newspapers. The result shows that it was mentioned in politics (482 cases, 56.1%) as the highest, followed by international (86 cases, 19.0%), and IT/Science (48 cases, 10.6%). In this part of the study, the conservative newspapers were more focused on the social field, whereas the progressive newspapers put more weight on the scientific field. Despite the fact that this survey deals with science and technology, it highly appears in politics and international because science and technology can be used as political tools like North Korea's nuclear weapons and military threats from the perspective of international media or view.

Figure 2 visualizes in network form connecting relations between subjects like figure, location, organization, and keyword extracted from the top 100 analyzed news on the reporting of North Korea science and technology among two newspapers. The cases of articles were set as 7 in total by weighting, and it was visualized with related words followed by keyword (6 cases), organization (5 cases), location (11 cases), and figure (5 cases). As a result, in keywords, 'president', 'Kim Jong-Un (chairman, vice chairman, leader)' were highly drawn, while the South Korean governments (Ministry of Defense, Ministry of Unification, Blue House) and the 'North Korea's Labor party' were highly related to organization. The U.S. and China had the highest proportion of locations, Kim Jong-Un had the highest proportion of figures, and South Korean presidents (Park Geun-Hye, Moon Jae-In) also had the highest proportion.
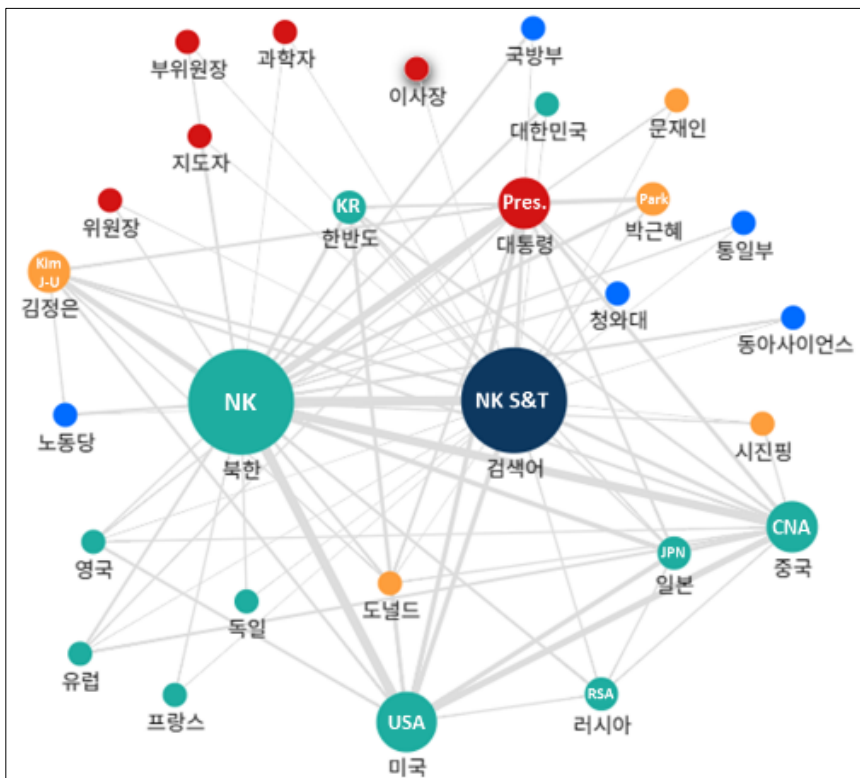

Figure 2. Network Analysis

Figure 3. Analysis of Related Words

In addition, keywords that are highly related to the analysis news among the search results related to 'North Korea Science and Technology' of the four newspapers were visualized as shown in Figure 3 according to the weighting. Accordingly, keywords with high weights were China (7.83), nuclear tests (7.5), South Korea (7.28), North Korea Central News Agency (7.22), and Kim Jong-un (6.48). This can be interpreted as the emphasis on negative views such as viewing North Korean science and technology in connection with China and nuclear tests in terms of weight. Here, it can be understood that the high proportion of the Korean Central News Agency reflects interest and interest in the North Korean media. On the other hand, the number of articles on related word analysis was higher in the order of Kim Jong-Un (175), China (160), Chairman (139), Pyongyang (113), and nuclear tests (72), and dealing with North Korean science and technology, focusing on Kim Jong-un, the supreme leader.

4.2 Results of Media frame and information source analysis

By the second operational definition, 154 articles were selected, and Dong-A tends to use sources from South Korea (49.6%) than North Korea (40.5%). On the contrary, Hankyoreh appears to use more sources from North Korea (52.7%) than South Korea (35.1%). Overall, information sources of overseas have about 9.9% in total. As a result, the conservative paper relies more on the source of South Korea; on the contrary, the progressive paper relies more on the source of North Korea.

As a result of frame analysis, in the South Korean media, positive frames (54.2%) accounted for a relatively higher proportion than negative frames (31.3%) in relation to North Korean science and technology. In addition, the

positive science and technology framed reporting was reanalyzed, and as a result, the reporting on international cooperation (17%) was high. In South Korean media, whether positive or negative, non-science and technology frames accounted for a greater proportion than science and technology frames. The analyzed result after dividing newspapers into conservative and progressive, the positive frame (64.9%) of the progressive newspaper was higher than the positive frame (44.5%) of the conservative newspaper. The conservative newspaper did not show much difference for each frame, but the progressive newspaper marked high with a positive-non-scientific technology frame (44.6%).

Table 3. Results of framing analysis on North and South Korea's Media

Category	Sub-category	Conservative Newspaper (Dong-a)		Progressive Newspaper (Hankyoreh)		Total	
Positive	S&T (International Cooperation)	44.5%	24.1% (15.2%)	64.9%	20.3% (18.9%)	54.2%	22.2% (17.0%)
	Non-S&T		20.4%		44.6%		32.0%
Neutral	Simple Fact	20.4%		10.8%		14.4%	
Negative	Threatening S&T	38.1%	17.7%	24.2%	14.7%	31.3%	16.3%
	Non-S&T		20.4%		9.5%		15.0%
Total		100%		100%		100%	

In the analysis of information sources, South Korean media mainly relies on in order of information sources from South Korea (43.4%), North Korea (30.1%), anonymous (17.5%), and overseas (12.1%). In the case of conservative newspapers, most of the information source is from South Korea (59.2%), North Korea (19.7%), anonymous and overseas (10.5%), while the information source of the progressive newspaper was from North Korea (38.1%), South Korea (30.9%), anonymous (17.5%), and overseas (13.4%). According to the analysis, the conservative newspaper relies more on information sources from South Korea, while the progressive newspaper relies more on information sources from North Korea and anonymous. In detail, the use of South Korean public and research institutes (25%) and government/local governments (17.1%) information sources was high, while the progressive sites were found to be North Korean media/media (18.6%) and anonymous (17.5%).

Table 4. Results of Information Source Analysis of South Korea's Media

Category	Sub-category	Conservative Newspaper (Dong-a)		Progressive Newspaper (Hankyoreh)		Total	
North Korea	Kim Jung-Un (Kim Jong Il, Kim Il Sung)	19.7%	6.6%	38.1%	10.3%	30.1%	8.7%
	Party and Government		2.6%		8.2%		5.8%
	Media		10.5%		18.6%		15.0%
	Private Sector		0.0%		1.0%		0.6%
South Korea	Governments	59.2%	17.1%	30.9%	9.3%	434%	12.7%
	National Assembly		3.9%		4.1%		4.0%
	Public Institutions		25.0%		15.5%		19.7%
	Media		3.9%		0.0%		1.7%
	Non-Government Organizations		2.6%		2.1%		2.3%
	Personal		6.6%		0.0%		2.9%
Overseas	International Organizations	10.5%	0.0%	13.4%	1.0%	12.1%	0.6%
	USA		1.3%		7.2%		4.6%
	China		5.3%		2.1%		3.5%
	Japan		0.0%		2.1%		1.2%
	Europe		3.9%		1.0%		2.3%
Anonymous		10.5%		17.5%		14.5%	
Total		100%		100%		100%	

4.3. Media reporting tendency of conservative and progressive governments

In South Korean media, the background and source of the conservative government in the order of North Korea (52.8%) and South Korea (37.5%), followed by South Korea (46.9%) and North Korea (40.7%) in the progressive government, showing opposite from the other. In the progressive government, the source of conservative newspapers from South Korea expanded from 37% to 55.8%, and from North Korea decreased from 59.3% to 30.8%. North Korean sources rose slightly about 9.7% and South Korean sources decreased slightly about 6.8%. Compared to the conservative government, the number of conservative newspapers tends to increase by about 10% from overseas sources

in the progressive government. In terms of the use of overseas information sources, China was high in the conservative newspapers, and the U.S. in the progressive.

Table 5. Results of Article Source analysis according to the conservative and progressive governments

Category	Conservative Government			Progressive Government		
	Dong-a	Hankyoreh	Total	Dong-a	Hankyoreh	Total
North Korea	59.3%	48.9%	52.8%	30.8%	58.6%	40.7%
South Korea	37.0%	37.8%	37.5%	55.8%	31.0%	46.9%
Overseas	3.7%	13.3%	9.7%	13.5%	10.3%	12.4%
Total	100%	100%	100%	100%	100%	100%

As a result of the frame analysis according to the conservative and progressive governments, the positive frame of the South Korean media was higher in the conservative government (73.6%) than in the progressive government (37%). The negative frame was significantly higher in the progressive government (45.7%) than in the conservative government (15.2%). Compared to the conservative government, the number of threatening science and technology frames (8.3 → 23.5%) and non-science and technology frames (6.9 → 22.2%) increased higher in the progressive government. In addition, in the progressive government, the positive-non-science and technology frame decreased significantly (▼23.4%), and the positive-science and technology frame (▼13.2%) also decreased significantly. What is noteworthy here is that the positive frame was significantly reduced (84.4→34.5%) in the progressive government, and the positive science and technology frame (33.3→0%) did not appear at all. In addition, the number of progressive lands increased significantly from 2.2% in the conservative government to 34.5% in the threatening science and technology frame.

Table 6. Results of framing analysis according to conservative and progressive governments

Category	Sub-category	Conservative Government						Progressive Government					
		Conservative Newspaper (Dong-a)		Progressive Newspaper (Hankyoreh)		Total		Conservative Newspaper (Dong-a)		Progressive Newspaper (Hankyoreh)		Total	
Posi-tive	S&T (International Cooperation)	55.6%	22.2% (11.1%)	84.4%	33.3% (31.1%)	73.6%	29.2% (23.6%)	38.5%	25.0% (17.3%)	34.5%	0.0% (0.0%)	37.0%	16.0% (11.1%)
	Non-S&T		33.3%		51.1%		44.4%		13.5%		34.5%		21.0%
Neutral	Simple Facts	11.1%		11.1%		11.1%		21.2%		10.3%		17.3%	
Nega-tive	Threatening S&T	33.3%	18.5%	4.4%	2.2%	15.2%	8.3%	40.4%	17.3%	55.2%	34.5%	45.7%	23.5%
	Non-S&T		14.8%		2.2%		6.9%		23.1%		20.7%		22.2%
Total		100%		100%		100%		100%		100%		100%	

As the government moved from the conservative to the progressive, the difference in information sources was high in the use of overseas sources (8.9 → 17.6%). In detail, the use of North Korean sources in the conservative government accounted for a high proportion of conservative land and South Korean sources in the progressive government. The number of progressive lands decreased significantly in the use of South Korean sources in the progressive government (18.2%) compared to the conservative government (41.5%). In the use of overseas sources, conservative land showed Chinese bias in the conservative government, but the use of Japanese sources in the progressive government increased significantly. Progressive newspapers showed that the use of U.S. sources was somewhat higher in the conservative government, but the proportion more than tripled in the progressive government. What is noteworthy here is that the number of anonymous or reports from unknown sources increased in the progressive government (22.7%) compared to the conservative government (13.2%). On the other hand, the conservative newspapers showed the opposite results.

Table 7. Results of Information Source analysis according to conservative and progressive governments

Category	Sub-category	Conservative Government			Progressive Government		
		Conservative Newspaper (Dong-a)	Progressive Newspaper (Hankyoreh)	Total	Conservative Newspaper (Dong-a)	Progressive Newspaper (Hankyoreh)	Total
Positive	(subtotal)	32.4%	35.8%	34.4%	7.3%	40.9%	24.7%
	Kim Jung-Un (Kim Jong Il, Kim Il Sung)	13.5%	11.3%	12.2%	0.0%	9.1%	4%
	Party and Government	5.4%	3.8%	4.4%	0.0%	13.6%	7.1%
	Media	13.5%	20.8%	17.8%	7.3%	15.9%	11.8%
	Private Sector	0.0%	0.0%	0.0%	0.0%	2.3%	1.2%
Neutral	(subtotal)	40.5%	41.5%	41.1%	73.2%	18.2%	44.7%
	Governments	13.5%	13.2%	13.3%	19.5%	4.5%	11.8%
	National Assembly	5.4%	7.5%	6.7%	29.3%	0.0%	14.1%
	Public Institutions	18.9%	17.0%	17.8%	7.3%	13.6%	10.6%
	Media	0.0%	0.0%	0.0%	2.4%	0.0%	1.2%
	Non-Government Organizations	2.7%	3.8%	3.3%	2%	0.0%	5.9%
	Personal	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Negative	(subtotal)	8.1%	9.4%	8.9%	17.1%	18.2%	17.6%
	International Organizations	0.0%	0.0%	0.0%	4.9%	2.3%	3.5%
	USA	0.0%	3.8%	2.2%	2.4%	11.4%	7.1%
	China	8.1%	1.9%	4.4%	2.4%	2.3%	2.4%
	Japan	0.0%	1.9%	1.1%	7.3%	2.3%	4.7%
	Europe	0.0%	1.9%	1.1%	2.4%	0.0%	1.2%
Anonymous		18.9%	13.2%	15.6%	2.4%	22.7%	12.9%
Total		100%	100%	100%	100%	100%	100%

5. Conclusion

For inter-Korean science and technology cooperation, in North Korea, the will of the supreme leader is absolutely important, but in South Korea as a democratic country, the understanding and support of the people are more important than the will of the government. Therefore, North Korean media reports should also be reported objectively and neutrally. Lim (2014:99-100) emphasizes that "it should lead our society to have a rational and rational perception and discussion of North Korea" through the efforts of raising the issue of bias of certain media and the constant reporting of facts by Korean media. The purpose of this study is to investigate the reporting tendency of the Korean media on 'North Korean science and technology,' which is a barometer of public understanding of inter-Korean science and technology cooperation, and to derive implications.

Foreign media often report North Korea as a reclusive country, and it can be seen that it is described rather than reported based on solid information. This is because there are difficulties in disclosing information. Because of COVID-19, they have become more isolated and plunged into a deeper world of seclusion. In this study, it is necessary to recall that South Korean media use South Korean intelligence sources when dealing with North Korean science and technology because it is most difficult to find direct information about North Korea. However, on the other hand, it is customized to the regime's stance.

The quantitative characteristics of the South Korean media on North Korean science and technology were as follows. The proportion of politics and international aspects was much higher than that of IT/science, which focuses on science and technology, and it could interpret those reports related to North Korea's science and technology as subordinate to domestic politics and somewhat biased toward international public opinion. Throughout the network analysis, the will of a powerful person who shows political determination in inter-Korean science and technology cooperation and cooperation of neighboring countries such as the United States and China are important. In the related words analysis, it clearly showed that the North Korean regime's willingness to develop science and technology and illegal science and technology frames were higher than that of North Korea's science and technology itself.

As for the analysis result of report frames and information sources, since Kim Jong-Un's reign, South Korean media have been generally positive about North Korean science and technology but have been dealing with science and technology incidentally in connection with other fields.

Similar to previous studies, there were many negative reports on the conservative newspapers and on the contrary, positive reports on the progressive

newspaper. South Korean media had a high rate of using South Korean sources because of its access to information, but there was a difference in political orientation in detail. Progressive newspapers showed a high utilization of North Korean sources, and conservative newspapers were high in South Korean sources. Lee (2020) also pointed out that false report on North Korea often comes from the closure of the North Korean system and the monopoly of information by intelligence agency such as the NIS, and it also gets affected by the attitudes of some opinion leaders, North Korean defectors, and North Korean media and YouTube.

The analysis of report frames and information sources according to the conservative and progressive governments showed paradoxical and unexpected results. In the conservative government, progressive newspapers showed a higher tendency to report positive reports than conservative newspapers. Looking at this trend, progressive newspapers showed a high reporting tendency in negative and threatening science and technology frames when the conservative government transitioned to the progressive government. Paradoxically, the progressive newspaper tended to make positive reports about the conservative government. On the other hand, the conservative government made positive reports, and the progressive government showed a tendency to have slightly negative reports.

In the conservative government, both conservative and progressive newspapers tended to use information sources at a similar rate, but in the progressive government, conservative newspapers showed a high rate of using South Korean sources, while the progressive newspapers tended to use more North Korean sources. In the progressive government, all newspapers have increased the use of overseas sources, and the number of anonymous or unmarked information sources has increased considerably especially in progressive newspapers.

It cannot be concluded that the South Korean media shows a similar trend based on the results of this study itself, but the information and knowledge on either conservative or progressive newspapers were different from the results of the previous studies that were conducted. It should discuss whether it is because of the high objectivity and fairness of the progressive media, which have been discussed in previous media studies, or because of external views toward the progressive government in further study. As Jeong (1997) mentioned, "Science media should play an active role in monitoring whether the national innovation system in a unified Korea operates in the direction of interactive learning and various forms of innovation through it." This study can be used as an opportunity to gauge the tendency of South Korean media to report on North Korean science and technology. Overall, it is expected to provide implications for public relations to promote inter-Korean science and technology exchanges and cooperation in the future.

References

Batenson, G. (1972). *Steps to an ecology of mind*. New York: Ballantine Books.

Bennett, W.L. (1996). *News: The Politics of illusions, 3rd*. New York: Longman.

Byun, H. (2021). *Evaluation and Prospect of North Korea's Science and Technology Policy during the Era of Kim Jung-Un*. in Korean.

Byun, H. (2018). North Korea's Vision of 'a Scientific and Technical Power' and the Inter-Korean Exchange and Cooperation of Science and Technology. *Journal of peace and unification*, 10(2), 81-113. in Korean.

Cho, D. and Yang, S. (2006). 80.5% of reporting are anonymous and 42% of information sources of these reporting are also known as anonymous. *Newspaper and Media* (pp.8-18). in Korean

Choi, C. Bea, S. and Kim, C. (2016). Applications of SMCRE Model on Social Amplification of MERS Risk Information and its Implications. *Journal of Distribution Science*, 14(6), 89-98.

Choi, J. and Ha, J. (2016). News Frames of Korean Unification Issues: Comparing Conservative and Progressive Newspapers. *Korean Journal of Communication Studies*, 24(2), 126-151.

Duffy, M.J. and Freeman, C.P. (2011). Unnamed sources: A utilitarian exploration of their justification and guidelines for limited use. *Journal of Mass Media Ethics*, 26(4), 297-315.

Entman, R. (1993). Framing: Toward Clarification of a Fractured Paradigm. J*ournal of Communication*, 43(4), 51-58.

Entman, R. (2004). *Projections of power: Framing news, public opinion and U.S. foreign policy*. Chicago: University of Chicago Press.

Gamson, W.A. and Modigliani, A. (1987). The changing culture of affirmative action, in Braungart, R.G. and Braungart, M.M. (eds.) *Research in political sociology*. Greenwich, CT: JAI Press, 137-177.

Gitlin, T. (1980). *The whole world is watching: Mass media in the making & unmaking of the new left*. Berkeley: University of California Press.

Goffman, E. (1974). *Frame analysis: An essay on the organization of experience*. New York: Harper & Row.

Ha, S. and Lee, M. (2012). A News Frame Analysis by the South Korean Press on the Livelihoods of a North Koreans. *Korean Journal of Communication & Information*, 222-241.

Itule, B.D. and Anderson, D.A. (2003). *New writing and reporting for today's media*. New York, NY: McGraw Hill.

Iyengar, S. (1991). *Is anyone responsible? How television frames political issues*. Chicago: University of Chicago Press.

Jung, S. (1997). Science and Technology in the Unification Era of the 21st Century: The Direction of Integrated Development of Science and Technology and the Rold of Science media. Science and Technology Policy (pp. 54-70). in Korean.

Jeong, A. & Kim, S. (2017). The 'Public Enemy' as a Constructed Reality: Understanding the Quality of News about North Korea. Culture and Politics, 4(4), 111-143. in Korean

Kang, H. (2020). A Brief History of North Korea's Science and Technology Policy for 70 Years. *History that opens Tomorrow*, 78, 276-292. in Korean.

Kim, C. and Kim, K. (2015). An Analysis of Frame in Conservative Presses and Progressive Presses with Emphasis on the Reported Articles of Cyber Smears. *The Journal of Social Science*, 22(4), 279-310. in Korean.

Kim, H. Kim, P. Yoo, H. and Kim, D. (2011). *Administrative and organizational form*. Goyang: Daeyoung. in Korean.

Kim, J. (2011). *The Passive Reporters.* Seoul: Hyohyung. in Korean.

Kim, J. (2018). The Problematization of North Korea's Nuclear Development and the Construction of National Identities – A Comparison of the Discourses of the Chosun Ilbo and the Hankyoreh. *The Journal of Asiatic Studies*, 61(1), 113-147. in Korean.

Kim, K. and Noh, G. (2011). A Comparative Study of News Reporting about North Korea on Newspapers in South Korea. *Korean Journal of Journalism & Communication Studies*, 55(1), 336-387. in Korean.

Kim, S. and Lee, C. (2002). An Experimental Study on the Effects of Television News Frame. *Korean Journal of Communication & Information*, 19, 95-123. in Korean.

Kovach, B. and Rosenstiel, T. (2001). *The elements of journalism.* New York, NY: Crown.

Lasswell, H.D. (1948). The structure & function of communication in society. In Bryson, L. (ed.), *The communication of ideas*. New York: Harper & Bros, also reprinted in Schramm, W. (ed.) Mass Communication, Urbana: University of Illinois Press, 117-130.

Lee, C. and Kim, J. (2015). The Changes and Implications of Science and Technology in the Kim Jong-un Era of North Korea. *STEPI Insight*, 173. in Korean.

Lee, H. (1989). The Trend of Scientific Reports in Korean Newspapers. *Korean Society for Journalism and Communication Studies*, 23-56. in Korean.

Lee, J. (2000). Frame, Interpretation, and Communication Effects. *Media & Society*, 85-153. in Korean.

Lee, J. (2014). Suggestions for reporting on North Korea. *Kwanhun Journal*, 130, 101-106. in Korean.

Lee, J. and Kim, J. (2000). News Sources and Conventions of Attribution in Korean Newspaper Reporting. *Korean Society for Journalism and Communication Studies*, 2, 160-181. in Korean.

Lee, S. and Rhee, J. (2014). Frame Contest and Utilization of Unnamed Sources in News Media. *Korean Journal of Journalism & Communication Studies*, 58(3), 378-407. in Korean.

Lee, S. et al. (2020). The KINU Unification Survey 2020: A Comparative Study on South Koreans' Perceptions of Neighboring Countries, Korea Institute for National Unification. *KINU Research Book*, 20-25. in Korean.

Lee, W. and Son, Y. (2011). The Medias Agenda Setting on the Nuclear Test of North Korea. *Korean Journal of Communication & Information*, 175-193. in Korean.

Lee, Y. (2020). How to solve North Korea's Coverage and Reporting Issues. *Kwanhun Journal*, 62(3), 39-47. in Korean.

Lee, Y. and Cho, Y. (2017). A Study of Perception of TV Reporters about Anonymous News Sources – Focusing on the Reporting Practice, Motivation, Effect of the

Anonymous Sources. *Korea Journal of Journalism & Communication Studies*, 61(5), 241-273. in Korean.

Lim, E. (2014). What is the problem with North Korean reporting? *Kwanhun Journal*, 140, 94-100. in Korean.

Ministry of Unification (2021). The last five years of North Korea through the 8th Party Conference. Official Blog of Ministry of Unification [Internet]. Available from: https://blog.naver.com/gounikorea/222254836776. in Korean.

Park, C. (2002). All the Science and Technology Policy gets established at the Parth. Science & Technology, 26-28. in Korean.

Park, D. (2015). A Study of Double Validity Claims in Quotations: News Source Network Analysis of News on the Four Major Rivers Project in the Dong-A Ilbo and the Hankyoreh. Korean Journal of Journalism & Communication Studies, 59(5), 121-151. in Korean.

Park, J. (2005). The Realization of Fairness: What Munhwa Ilbo did for the Fair Coverage of the 2002 Presidential Election and How? Korean Journal of Journalism & Communication Studies, 49(2), 167-195. in Korean.

Park, S. (2004). A Comparative Analysis of Society Section in Newspaper. Seoul: Media Institute. in Korean.

Shim, H. (2004). Natural Famine or Political Famine? : Ideological Coverage of the North Korea Disasters in the New York Times and the Washington Post. *Korean Journal of Journalism & Communication Studies*, 48(1), 57-83. in Korean.

Son, Y. and Hong, J. (2019). Newspaper Frame Analysis on the Nuclear Crisis in Korean Peninsula. *The Journal of Political Science & Communication*, 22(3), 175-210. in Korean.

Song, J. (2018). A Plan to Participate on Development of North Korea for Private Investment linking International Cooperation Framework. *Seminar and Advisory Meeting for Inter-Korean Environmental Cooperation*. in Korean.

Song, J. et al. (2018). Prospects for North Korea's Infrastructure Development Project through Cases of Existing Transition Countries. *GTC Issue Paper*, 1-56. in Korean.

Yang, S. (2016). Analysis on THAAD placement in Korea and East Asian media Trends – focused on news frames of Korea, China, Taiwan, and Hong-kong newspapers. *Asian Cultural Studies*, 42, 261-292. in Korean.

Yoo, J. and Lee, M. (1994). *Government and Media*. Seoul: Nanam. in Korean.

Yoo, N. and Kim, J. (2020). Strategies to Promote S&T Cooperation between South and North Korea. *KISTEP Issue Paper*. in Korean.

Zhao, B. and Choi, N. (2018). Comparative Analysis of the Frames between Koreas Conservative Press and Progressive Press, Focused on Reports related to THAAD. *Korean Journal of Social Science*, 39(2), 81-114. in Korean.