

## **Media coverage of the conflicts over the 4th Industrial Revolution in the Republic of Korea from 2016 to 2020: a text-mining approach**

**Jiseong Yang<sup>\*</sup>, Byungjun Kim<sup>\*\*</sup>, Wonjae Lee<sup>\*\*\*</sup>**

**Abstract** The media has depicted an abrupt socio-technological change in the Republic of Korea with the 4th Industrial Revolution. Because technologies cannot realize their potential without social acceptance, studying conflicts incurred by such a change is imperative. However, little literature has focused on conflicts caused by technologies. Therefore, the current study investigated media coverage regarding conflicts related to the 4th Industrial Revolution from 2016 to 2020 in the Republic of Korea, applying text-mining techniques. We found that the overall amount and coverage pattern conforms to the issue attention cycle. Also, the three major topics (“SMEs & Startups,” “Mobility Conflict,” and “Human & Technology”) indicate quarrels between conflicting social entities. Moreover, the temporal change in media coverage implies the political use of the term rather than technological. However, we also found the media’s deliberative discussion on the socio-technological impact. This study is significant because we expanded the discussion on media coverage of technologies to the realm of social conflicts. Furthermore, we explored the news articles of the recent five years with a text-mining approach that enhanced the objectivity of the research.

**Keywords** emerging technologies, media, social conflicts, the 4th Industrial Revolution, Structural Topic Modeling, cosine similarity

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## **I. Introduction**

For emerging technologies to be successful, public understanding of those technologies is essential (Frambach & Schillewaert, 2002; R. Roberts et al., 2021). The public significantly influences science and technology funding, usage, and regulation (Scheufele, 2013). To increase public understanding, addressing how online media consumes emerging technologies is crucial because the media plays a vital role in delivering information, setting the agenda, and eliciting social acceptance (Schäfer, 2017). Along this line, a strand of literature discussed the media coverage of specific emerging technologies such as Artificial Intelligence (AI), nanotechnology, and the likes (Anderson et al., 2012; Cacciatore et al., 2012; Li et al., 2019; Metag and Marcinkowski, 2014; Strekalova, 2015; Sun et al., 2020).

Media coverage of emerging technologies is diverse, implying different stakeholders' perspectives on emerging technologies (Anderson et al., 2012; Cacciatore et al., 2012; Metag and Marcinkowski, 2014; Sun et al., 2020). Accordingly, conflicts among heterogeneous social actors with different preferences or competition between emerging and existing technologies can occur during the diffusion of new technologies (Alkemade and Suurs, 2012). However, limited attempts have previously aimed to address media coverage of conflicts over emerging technologies.

This article aims to illuminate media coverage regarding conflicts related to the 4th Industrial Revolution (4IR) from 2016 to 2020 in the Republic of Korea (ROK). We focused on the 4IR because the term implies grand socio-technological transitions and has gained popularity, especially in the ROK. Technological innovation promotes the redistribution of political and economic resources (Frey, 2019), and conflicts occur because different social groups compete over limited resources (Jackson, 1993). Thus, the 4IR is inseparable from social conflicts. Although a series of extant literature examined the media coverage of the 4IR in the ROK (Choi et al., 2019; Noh, 2020; Yoon, 2018a), media coverage of conflicts over the 4IR (the 4IR conflicts) is understudied.

We collected online news articles whose titles or contents include “the 4th Industrial Revolution (4 차 산업혁명)” and “conflicts (갈등)” from Naver News Portal, the most dominant news platform in the ROK in terms of the number of users. The objectives of the study are as follows. Firstly, we provide descriptive statistics on the general amount and pattern of media coverage of the 4IR conflicts. We, in turn, not only delve into the major topics about the 4IR conflicts using Structural Topic Modeling (STM) but also observe the dynamic changes in the major topics of them, computing document similarity.

## **II. Literature Review**

### **1. Media coverage of emerging technologies**

Social sciences have paid considerable attention to media coverage of emerging technologies, focusing on the influence of media on the public regarding science and technology (Schäfer, 2011, 2017; Scheufele, 2013). A line of studies focused on the difference in media coverage of scientific and technological issues between online and print media. Anderson et al. (2012) empirically investigated whether the issue attention cycle observed in print media also appears in online media. They discovered that online media covered the scientific studies on the fatality of nanoparticle inhalation ten times more than its traditional counterpart and found that the attention on the issue survives longer in online media. Cacciatore et al. (2012) shed light on the coverage of nanotechnology in print and online news media in the US. The study revealed a clear difference: online media does not merely replicate the traditional news media portrayals but provides their own.

Another strand of research performed thematic analysis to explore the media's attitude towards emerging technologies. A study elucidated whether a negativity bias or technophobic perspective exists in media coverage of nanotechnology (Metag and Marcinkowski, 2014). Contrary to the existing perception, the study showed that the media maintained an affirmative attitude towards relevant scientific advancement and scientists. However, they qualified their findings because they also noticed the function of media as a critique. Strelakova (2015) performed an exploratory analysis on nanomedicine coverage by the elite and regional newspapers. Her research showed that the frame focusing on nanomedicines' benefits was the most dominant.

Some scholars paid attention to the social aspects of emerging technologies. Sun et al. (2020) studied how media communicate information about AI to the public. The study indicated that media focused on AI technologies to solve social problems and discovered topics concerning government regulation on technologies (e.g., robot/humanoid, brain science/intelligence). Li et al. (2019) considered social awareness of emerging technologies. They showed the public sentiment towards technologies over time and investigated which topics gained more spotlight from the public over others.

### **2. Media coverage of the 4IR in the ROK**

The 4IR started to draw attention in the ROK with the publication of "The 4th Industrial Revolution" (Ha and Choi, 2015; Moon and Seol, 2017), as well as the World Economic Forum (WEF) in 2016. Massive interest in the 4IR led to

a series of text-mining studies conducted to understand the content and nature of the 4IR discourse (Choi et al., 2019; Noh, 2020; Yoon, 2018a). Along this line of research, the first seminal attempt explored the context under which media consumed the 4IR discourse in the ROK (Yoon, 2018a). The study conducted a series of text-mining methods, such as topic modeling and semantic network analysis, on the 4IR media coverage. The 4IR was used to describe political agendas rather than deliberation on the socio-technological impact of emerging technologies in the ROK media. Though the 4IR started as a discourse pondering the social implications of technological advancement, the term established itself as a means to drive economic growth over time. However, the study only considered the titles of news articles, with which the question of validity remained.

Adding to the previous research, Choi et al. (2019) applied co-occurrence analysis and topic modeling to the full text of online newspapers about the 4IR from 1 January 2016 to 30 September 2018. They discovered that the main themes of the 4IR media coverage varied through subperiods: the main keywords in each period were associated with timely adjacent political events or policies of the government. Relevant studies consistently interpreted the 4IR in the political context rather than solely technological (Choi et al., 2019; Yoon, 2018a; Yoon, 2018b).

The most recent work is a topic modeling analysis on the 4IR news articles by Noh (2020). Assuming that the media's interest reflects that of the public, she extracted ten topics (issues) related to the 4IR represented via news media between 2018 and 2019 using topic modeling. She paid attention to enhancing the model's validity and illustrated the process of selecting the optimal number of topics considering both Pointwise Mutual Information (PMI) and perplexity.

In summary, media plays a vital role in discussing the social implications of technologies that necessarily accompany social conflicts. Considering the 4IR suggests the socio-technological transitions of the ongoing society, media coverage of the 4IR conflicts is optimal for studying how media present relevant issues to the public. In the light of the above literature, we aimed to find answers to the following research questions:

- Research Question 1:** What is the general amount and pattern of media coverage on the 4IR conflicts?
- Research Question 2:** What are the major topics about the 4IR conflicts that the media presents?
- Research Question 3:** How do the major topics about the 4IR conflicts change over time?

### **III. Methods**

#### **1. Data**

We searched for Naver News articles that matched “the 4th Industrial Revolution” and “conflicts” in the title or the content. We chose Naver News Portal as the data source because they best represent the public opinion in the ROK. The Korea Press Foundation Korea Press Foundation (2020) reported that 75.8% of Koreans consume news via Internet portals, 90.7% of which use the Naver Portal.

The temporal range of the data collection is from 1 January 2016 to 31 December 2020. The starting point is 2016 because it is when the WEF proclaimed the concept of the 4IR. We wrote a Python program to scrape news articles from the Web automatically. We only selected in-link articles that fit Naver’s uniform format among the search results for ease of data collection. We collected data from 1 January 2020 to 9 February 2020. Immediately after the initial collection, the tally of articles was 12,099.

We excluded some articles we did not deem to serve our research goal. We removed headline summary articles or editorials because they did not convey meaningful messages about the 4IR discourse. We also removed articles whose publishers are government or political parties because they are not the typical media types we consider in the research context. The local newspapers were also excluded since we needed to grasp the nationwide discourse. As for the specialized newspapers, we only selected ones regarding IT and science. After getting rid of duplicates, we finally obtained 11,081 articles.

We preprocessed the data adequately for the subsequent analysis. We merged the title and the text, which is the unit of the analysis. Then we deleted unnecessary punctuations and phrases. For example, many articles on the Naver News Portal include links to relevant articles or advertisements below the main content. As they are irrelevant to the main messages of the articles, they may deter the accuracy of the analysis.

Researchers must appropriately control synonyms to improve the accuracy of a text-mining analysis. There were some words that a human reader would treat as semantically identical. However, it is not the case for a computer if those words are syntactically different. For example, “Moon Jae-in” and “President Moon” have the same meaning, but the computational process will not distinguish those words without additional treatments. Thus, we established headings (i.g., “Moon Jae-in”) and replaced synonyms with those headings.

Tokens are the basic unit of analysis of a corpus, and we only considered nouns and pronouns in tokenizing the text. Compared to nouns, verbs or adverbs often are ambiguous, so researchers will find it challenging to make sense of

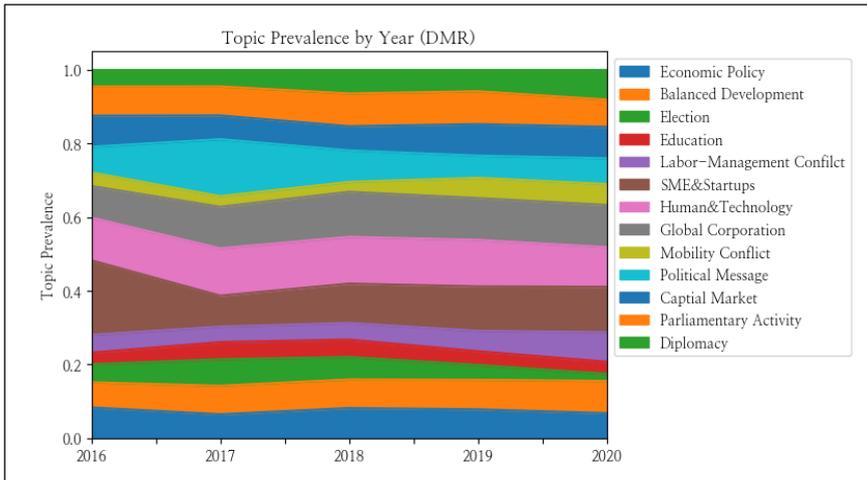
their contextual meanings. As for pairs of consecutive tokens that frequently occur across articles, we added them to a user-vocabulary such that the tokenizer recognizes these pairs as we intended.

## **2. Structural Topic Modeling**

Topic modeling is a group of inductive techniques to discover latent topics in contextual data (Lindstedt, 2019). Topic modeling is used in various forms of data analysis, such as bioinformatics, social data, and environmental data, but is particularly suitable for analyzing textual data (Vayansky and Kumar, 2020). Some studies adopted topic modeling to explore technological or socio-technological trends (Hussain et al., 2021; Jeon and Suh, 2017). Latent Dirichlet Allocation (LDA) is the simplest generative probabilistic model widely used in academia (Roberts et al., 2014, 2019; Vayansky and Kumar, 2020). LDA considers each topic distribution of words, each document a mixture of topics, and estimates the topic content and topic prevalence. Topic prevalence is the distribution of the topics in a document (Blei et al., 2002; Roberts et al., 2014). LDA has strength in textual analysis in terms of simplicity, dimensionality reduction, interpretability, and semantic coherence of data (Mimno and McCallum, 2008).

However, LDA has a disadvantage: it cannot estimate the effect of documents' bibliographic information (or metadata) on topic prevalence. Mimno & McCallum (2008) proposed Dirichlet Multinomial Regression (DMR) to extend LDA, which can integrate metadata from documents such as authors or issued dates into the topic model. Figure 1 exemplifies the topic prevalence estimated by DMR. The model considered years of news articles uploaded or modified on the portal. It provides additional information, for example, that the "Human & Technology" topic (pink) takes up a noticeable proportion among other topics from 2017 to 2018.

In the DMR model, "year" as news articles' metadata is considered a nominal variable. A limitation of this model is that it is challenging to keep track of subtle changes in trends or patterns over time. As we aim to illuminate the dynamic fluctuation of media coverage of the 4IR conflicts, we needed more advanced methods to achieve this goal. STM is an extension framework for LDA (Lindstedt, 2019). STM adopts a generalized linear model to estimate the effect of covariates (metadata) on topic prevalence (Hu et al., 2019). In the current study, we transformed each article's uploaded/modified dates into days such that the date of the first article is day 1. Then we applied B-spline to these values using the function provided by the R package for STM (see Roberts et al., 2019, p.9).



**Figure 1 Topic prevalence by year (DMR)**

As STM is an unsupervised model, it is up to the researchers to set the optimal number of topics. It is crucial in terms of the validity of a model to confirm an adequate number of topics. However, there is no straightforward way to select the number of topics that yield readily interpretable and meaningful results (Farrell, 2016; Lindstedt, 2019). This paper followed Lindstedt’s (2019) suggestion to find a trade-off between semantic coherence and exclusivity. We calculated semantic coherence (x-axis) and exclusivity (y-axis) by the number of topics (k) ranging from five to one hundred (see Figure 2). Exploring the upper right-hand quadrant of the figure, we finally extracted and named thirteen topics (see Lindstedt, 2019, pp. 311-312).

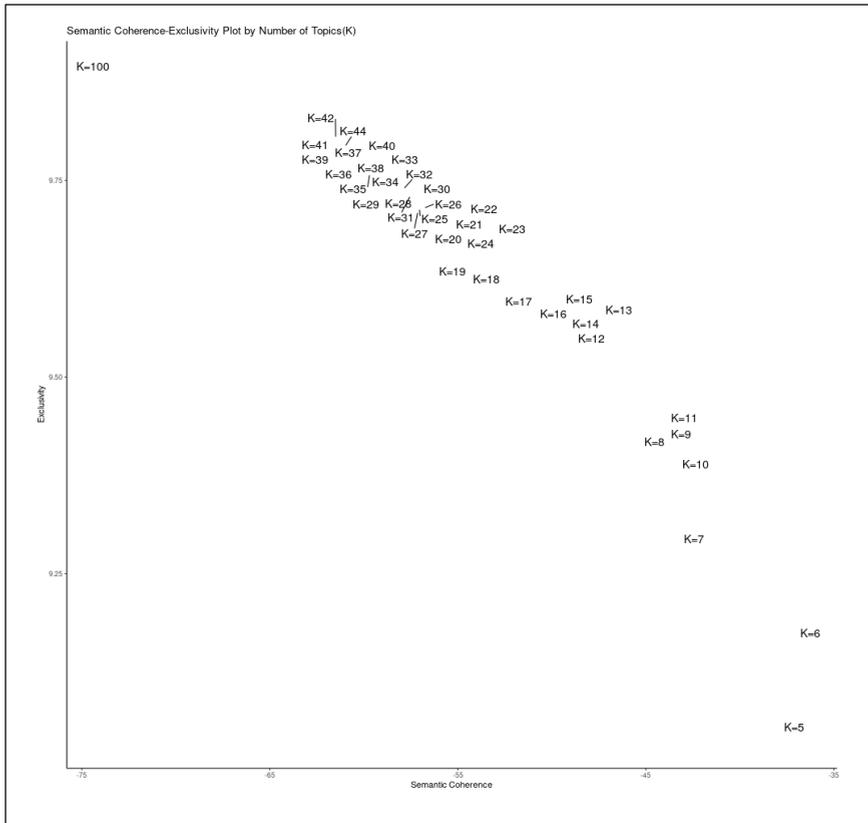


Figure 2 Semantic coherence & exclusivity by the number of topics

## IV. Results

### 1. The amount and pattern of media coverage on conflicts over 4IR

To answer **Research Question 1**, we calculated and plotted the overall amount and pattern of media coverage of the 4IR conflicts from 2016 to 2020. Table 1 shows the yearly media coverage and year-over-year (YoY). The media coverage of the 4IR conflicts was only 561, which skyrocketed by 421% in the following year. From 2018 to 2020, we observed up-and-down patterns in the amount of media coverage. After reaching its peak in 2017, the number decreased by 17% in 2018, increased by 36% in 2019, and finally dropped by 43% in 2020. Figure 3 illustrates the patterns more visibly by showing the monthly changes in media coverage of the 4IR conflicts, with the x-axis

denoting every month and the y-axis the frequency counts of the coverage of the 4IR conflict. We added vertical lines (red dotted) to delineate the boundaries between each year in Figure 3.

**Table 1 Amount of media coverage and year-over-year**

Year	Amount of media coverage	YoY
2016	561	-
2017	2,923	421%
2018	2,425	-17%
2019	3,293	36%
2020	1,879	-43%
Total	11,081	-

## 1. Major topics about conflicts over 4IR

To explore **Research Question 2**, we extracted thirteen topics from the articles on the 4IR conflicts using STM. Table 2 demonstrates each topic's names, prevalence, and keywords (decreasing order by proportions). We found the top three topics in terms of topic prevalence- "SME & Startups," "Human & Technology," and "Mobility Conflicts." They altogether take up 34.56% of topic prevalence.

The "SMEs & Startups" topic, whose topic prevalence is 12.86%, describes the government's effort to support small and medium enterprises (SMEs) and promote startups, led by the Ministry of SMEs and Startups. The topic is also intimately associated with the Moon Administration's keynote economic policies, such as Innovative Growth and Income-led Growth. The idea underlying these policies is to fundamentally change the economic structure and drive economic growth with innovations led by SMEs. The topic depicts the conflicts among multifold organizations mainly caused by regulations.

The "Human & Technology" topic that takes up 11.56% themes the socio-technological changes posed by emerging technologies such as AI and robots. The previous Industrial Revolutions tremendously reshaped the socio-economical structures. Hence, a fundamental fear of new technologies replacing human labor and traditional values has always been present. The topic shows that the media deliberated on such fears that AI may someday negatively transform the very way of human life.

The "Mobility Conflict" deals with the conflict among mobile service providers (notably, Kakao Mobility and Tada), the taxi industry, and the government. It is the third prevalent topic in media coverage of the 4IR conflict (10.14%). The mobility conflict revolves around the legal legitimacy of a new

form of transportation service, questioned by taxi industries; it shows that the ROK media has depicted the entailing controversy as an iconic event related to the 4IR.

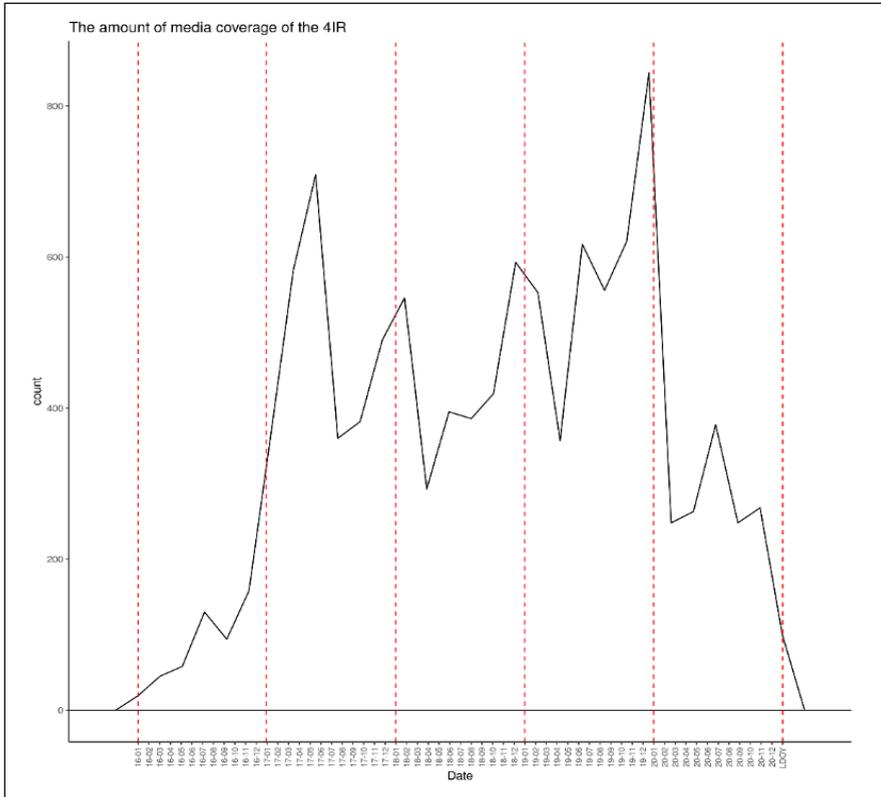


Figure 3 The amount of media coverage of the 4IR

**Table 2 Topic names, prevalence, and keywords**

Topics	Proportion	Keywords
SMEs & Startups	12.86%	SME, deputy prime minister, policy, venture, Innovative Growth, Economy, Private, growth, creation, ministry, structure, Ministry of Economy and Finance, Regulation, corporate, Income-led Growth, direction, distribution, Ministry of SMEs and Startups, finance, vitality
Human & Technology	11.56%	human, science, intelligence, digital, artificial, robots, knowledge, revolution, humanity, AI, author, world, generation, media, machine, century, technology, data, concept, illness
Mobility Conflicts	10.14%	ride-sharing, taxi industry, taxi, carpool, sharing economy, operator, Kakao, Uber, service, mobility, Tada, vehicle, user, hackathon, permission, rate, industry, regulation, committee on the fourth industrial revolution, commuting
Balanced Development	9.32%	city, Jeju, provincial residents, residents, Gwangju, airport, complex, public election, facility, Busan, Daejeon, composition, citizen, Gyeonggi province, region, village, self-governance, the capital city, attraction, urban regeneration
Global Corporations	7.76%	vice-chairman, Group, Samsung Electronics, Samsung, president, electricity, 5G, chairman, SK, memory, LG, electronics, product, management, energy, cloud, manufacturing, R&D, acquisition, parts
Parliamentary Activities	7.31%	floor leader, National Assembly, special committee, candidate, Blue House, Chung Sye-Kyun, the ruling party, hearing, investigation, appointment, prosecution, ruling and opposition parties, state affairs, the opposition party, personnel, judicial, bill, Speaker of the National Assembly, Speaker, Cho Kuk
Elections	7.02%	candidate, Ahn Cheol-soo, running for office, presidential election, conservative, People's Party, political party, election, impeachment, general election, progressive, Hong Jun-Pyo, primary, approval rating, election, voting, power, Park Geun-Hye, support, Bareun Party

US-China Conflict	6.56%	Trump, USA, Huawei, trade (무역), China, tariff, US-China, Japan, hegemony, trade (통상), export, war, item, homeland, Donald, dispute, FTA, dependency, Davos Forum, UK
Labor-Management Conflicts	6.45%	wage, union (조합), labor-management, labor (노동), labor (근로), basic income, regular, worker, union (노동조합), worker, employment, minimum, payment, labor-management-policy, strike, Korea Enterprises Federation, income, unemployment, Federation of Trade Unions, insurance
Diplomacy	5.78	Korea-China, bilateral, summit (회담), ASEAN, North Korea, summit (정상), exchange, cooperation, Inter-Korea, visit, peninsula, ASEAN, Olympics, Korea-Japan, attend, Beijing, prosperity, meeting, diplomacy, ambassador
Capital Market	5.63	bank, interest rate, stock, quarter, securities, finance, rise, stock market, price, decline, investor, stock price, fund, previous year, index, asset, KOSDAQ, performance, game, economy
Political Messages	5.42	fairness, inclusion, ROK, people's livelihood, new year's address, leap, peace, budget, new year, equality, everyone, privilege, democracy, justice, the authority of power, hope, candlelight, senior citizen, youth, class
Education	4.18	student, university, superintendent, school, education, Ministry of Education, Office of Education, parent (학부모), teacher, class, kid, Seoul National University, president, entrance exam, parent (부모), CSAT, math, high school, learning, talent

## 2. Dynamic changes of major topics about conflicts over 4IR

Firstly, to investigate **Research Question 3**, we provided quantitative evidence that media coverage of the 4IR follows political events and used those events as boundaries for subperiods. Secondly, we investigated the dynamic change in topic prevalence for three major topics selected in the previous section.

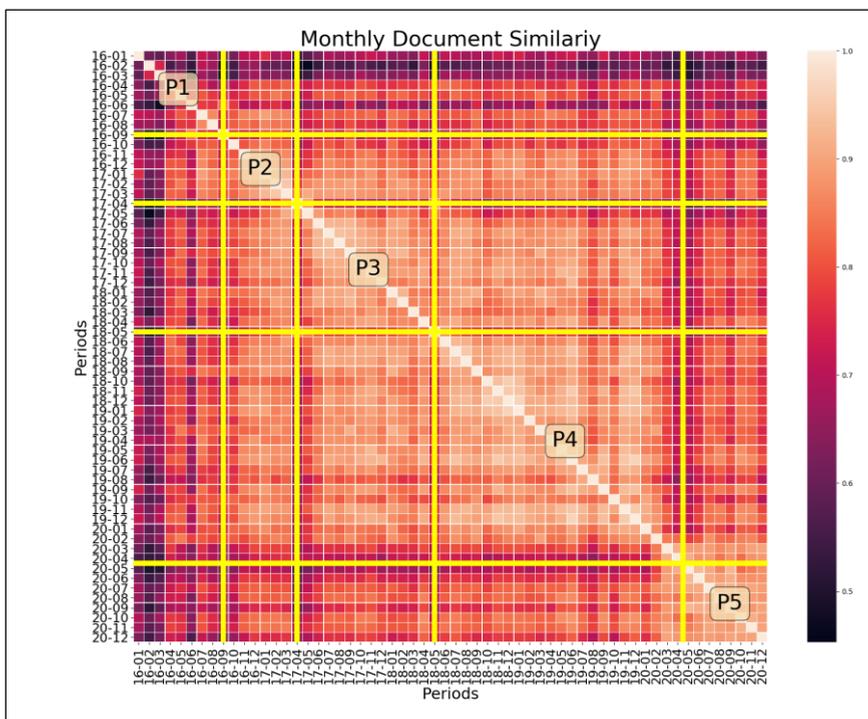


Figure 4 Monthly document similarity and boundaries for subperiods

Table 3 Five periods and descriptions

Periods	Date Range	Description of Boundaries
Period 1	2016.01.01 - 2016.09.01	the introduction and diffusion of the 4IR in the ROK
Period 2	2016.09.02 - 2017.05.09	the discussion of the 4IR in the National Assembly
Period 3	2017.05.10 - 2018.06.13	the inauguration of the Moon Administration
Period 4	2018.06.14 - 2020.04.15	the 7th Local Election
Period 5	2020.04.16 - 2020.12.31	the 21st General Election

We split the entire article that spans five years into sixty monthly documents. Then we created a Term Frequency-Inverse Document Frequency (TF-IDF) matrix with the top 500 keywords where rows are monthly documents and columns are keywords. Based on this matrix, we calculated the cosine similarity. Figure 4 visualizes the cosine similarity matrix and shows how similar each monthly article is to others in terms of common keywords. The more similar a

pair of documents are, the brighter the color is.

We drew yellow lines on the point where adjacent document similarity goes below 0.75. These are boundaries where the nature of the discourse changes, and we found that these boundaries coincide with major political events in the ROK. We classified five subperiods from Period 1 (P1) to Period 5 (P5), split by these empirically obtained boundaries.

Table 3 provides descriptions of the political events that occurred during each period. P1 covers the coinage and diffusion of the 4IR from 1 January 2016 to 1 September 2016. The 4IR starts to appear in political speeches at the regular session of the National Assembly in P2, which ranges from 2 September 2016 to 9 May 2017. P3 spans from 10 May 2017 to 13 June 2018, between the inauguration of the Moon Administration and the 7th Local Election. After the 7th Local Election until the 21st General Election from 14 June 2018 to 15 April 2020 is P4. Lastly, P5 includes the days after the 21st General Election until the last day in the data.

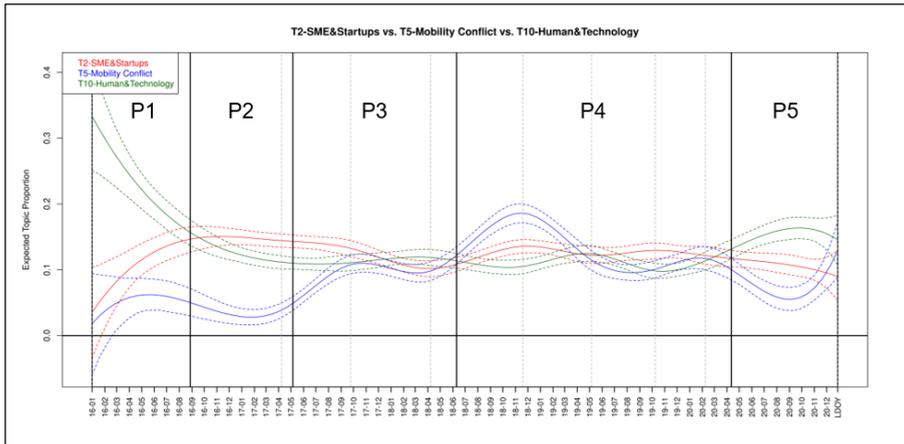
Next, we will investigate the dynamic change of topic prevalence using STM. Figure 5 shows and compares the dynamic changes of the “SMEs & Startups (red),” “Mobility Conflict (blue),” and “Human & Technology (green),” which were the top three topics in terms of topic prevalence. Solid lines indicate the mean expected topic proportion while dotted lines the 95% confidence interval. If a topic’s lower bound of a confidence interval is above the upper bound of another topic’s confidence interval, the topic prevalence of the former topic is significantly greater than that of the second one. Also, we denoted the boundaries between subperiods with thick black vertical lines.

The “SMEs & Startups” topic, colored in red, grows in P1, showing a slight decrease throughout P2 and P3. Despite the descending trend, the topic is significantly more prevalent than other topics. However, at the beginning of P4, the topic rises again along with the ascending of the “Mobility Conflict” topic; a massive demonstration of taxi drivers against Kakao mobility took place at the time. However, the topic prevalence does not significantly surpass that of the “Mobility Conflict” topic, whereas significantly higher than the “Human & Technology” topic.

The “Mobility Conflict,” plotted with blue lines, has three peaks—one in P3 and two in P4. The first peak in P3 reflected the initial stage when the introduction of mobility services caused conflicts between service providers (e.g., UberShare, Chacha, and Poolers) and local governments. The second peak has something to do with the massive protest of the taxi industry. The topic is the most prevalent topic over two other topics during this peak. However, the prevalence of the three topics in the third peak is not significantly different because all of their confidence intervals overlap.

The “Human & Technology” topic, drawn by green, is significantly more prevalent than the other two topics in P1. Sparked by the WEF, AlphaGo Shock,

and relevant publications, the 4IR conflict discourse started as socio-technological deliberation. However, the topic prevalence decreases rapidly throughout P1 and P2; the topic becomes the least prevalent in the first half of P4 compared to other topics. The topic bounces back in P5, which was the period a broad discussion on basic income went on after the 21st General Election. In P5, the topic is significantly dominant over the rest of the topics.



**Figure 5 Dynamic change of topic prevalence of “SMEs & Startups,” “Mobility Conflict,” and “Human & Technology”**

## V. Discussion

Building on the literature on media coverage of emerging technologies, we illuminated how media covered conflicts concerning emergent technologies, shedding light on media coverage of the 4IR conflicts in the ROK for five years since 2016. To answer the research questions, we provided the overall amount and pattern of media coverage of the 4IR. Also, we discovered the three major topics regarding the 4IR conflicts using STM (“SMEs & Startups,” “Mobility Conflict,” and “Human & Technology”). Moreover, with the aid of subperiods determined by cosine similarity, we observed and explained the dynamic behaviors of three major topics.

The general amount and pattern of the 4IR conflict resemble to issue attention cycle.<sup>1</sup> The issue attention cycle explains a cyclic pattern of public attention on

<sup>1</sup> An alternative explanation is also possible: Garter’s hype cycle model is widely used to predict expectations or visibility of a value regarding a technology over time (Dedehayir &

specific issues that eventually decreases over time as the initial expectations or newsworthiness of specific issues perceived by the public decays (Anderson et al., 2012). The coverage of the 4IR conflicts leaped dramatically in the early stage as the term propagated across the media. Given that the politics and media had positive expectations of the 4IR to solve low economic growth and social problems (Yoon, 2018b), the initial surge of media coverage seems plausible. Also, the articles' volume decreased over time through a repetitive rise and fall. Finally, the 4IR coverage that peaked at the end of 2019 rapidly lost media attention in early 2020.

The topics of "SMEs & Startups," "Mobility Conflict," and "Human & Technology" indicate the most prevalent conflicts in the context of the 4IR. "Human & Technology" implies the conflict between developing technologies and society, which always has existed in the wake of rapid social changes caused by technological advancement. We also contend that "SMEs & Startups" and "Mobility Conflict" topics share a common element: they are essentially the conflict between the driving and deterring forces of innovation. The government adopted the 4IR discourse to drive economic and industrial growth (Yoon, 2018a; Yoon, 2018b). However, such an attempt faces challenges regarding the obsolete legal system and the resistance from existing industries.

Such thematic changes in media coverage of the 4IR conflict indicate that the government had promoted the term more politically. Thus, media coverage of the 4IR may follow the discourse led by the government and politics. According to the indexing theory, the media pays more attention to limited sources of information, usually government officials or politicians (Bennett, 1990). The theory may explain the result of our document similarity analysis that media coverage of the 4IR depended on political events.

Scholars pointed out that the 4IR is accepted and consumed in a politically-oriented manner in the ROK (Yoon, 2018a; Yoon, 2018b). Despite such criticism, the "Human & Technology" topic proposes the possibility that media played an essential role in maintaining deliberative discussions on the social impact of technologies; this topic is relatively independent of political context compared to the other two topics that focused on the political entities' intervention to mediate conflicts caused by the 4IR. Although subdued by other topics at some points from P2 to P4, socio-technological deliberation eventually revived in P5, not to mention that it was the prevalent discourse at the early stage in P1.

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Steinert, 2016). Attention paid to a technology reaches a pinnacle in the early stage of introduction (bubble stage), goes through an abrupt decline due to disappointment (disillusionment stage), and finally recovers as the technology advances (Jun, 2012; Jun et al., 2013).

The contribution of this study is that we observed the socio-technological media coverage in general, primarily focusing on social conflicts. Also, we included the articles with the broadest temporal range compared to other existing studies. It was possible because we used a text-mining approach which has an advantage in processing a large amount of data, maximizing the objectivity of the research.

Nonetheless, the current study also has limitations. Our search keywords, “the 4th Industrial Revolution” and “conflicts,” encompass a broad array of discourses. Some collected articles may be irrelevant to the emerging technologies but solely political content. Moreover, we need to investigate further the possibility that the intense research and innovation network in the ICT field could have influenced the government to accept the 4IR, leading to its political use of the term. Furthermore, it is imperative to directly observe the public response to extend to a richer discussion on the public acceptance of technologies. We suggest that future analysis include online news comments.

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