

Content Analysis on Twitter for Identifying Scholarly Activities and Public Use in Informal Communication: With a Focus on Domestic Scholars in Social Sciences*

트위터 데이터를 이용한 연구자들의 비공식 커뮤니케이션 활동 및 대중이용 내용분석:
국내 사회과학 분야 연구자들을 중심으로

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ABSTRACT

This study aims to identify and categorize the content and public use patterns of social scientists' informal communication activities. Using Twitter data, we identified Korean 736 social scientists who participated in communication activities with the public, and analyzed 4,548 tweets that revealed their informal communication activities. This study is meaningful in that it explored informal communication between social scientists and the public, which was not previously revealed in scholarly communication, and identified the types of informal communication activities, communication media, and collaborative sectors in detail.

초 록

본 연구는 사회과학 연구자의 비공식 커뮤니케이션 활동 및 대중이용 패턴을 파악하고 범주화하는 데 초점을 맞춘다. 트위터 데이터를 이용하여 대중과의 커뮤니케이션 활동에 참여한 국내 사회과학 연구자 736명을 식별하고, 이 연구자들의 비공식 커뮤니케이션 활동이 드러난 트윗 4,548개를 내용분석하였다. 본 연구는 지금까지 학술 커뮤니케이션 연구에서 밝혀지지 않았던 사회과학자와 일반대중 간의 비공식적인 커뮤니케이션을 탐색하고, 구체적인 비공식 커뮤니케이션 활동 내용, 커뮤니케이션 매체 및 협업 분야의 유형을 식별했다는 점에서 의미가 있다.

Keywords: scholarly communication, informal communication, scholarly activity, public use, twitter, content analysis,

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1. Introduction

Effective sharing and dissemination of scholarly information generated by research activities is a major topic in scholarly communication. To facilitate scholarly information flow, most literature on scholarly communication has focused on information needs and usage patterns of scholars (Case & Given, 2016). Identifying knowledge structures in specific disciplines or subject areas has also been actively discussed (Börner, Chen, & Boyack, 2003). The primary purpose of these studies was to promote knowledge transfer within the scholarly community.

Notably, in the real world, the information produced by scholars is not only used by their peers but also by the public. A common example is when scholars disseminate their research knowledge to the public through scientific books. Professor Robin Dunbar described human psychological evolution story in a book called *Human Evolution: Our Brains and Behavior*, in which he makes it easy for the general public to understand human behavior and the rationale behind it. In a similar vein, scholars have published a series of humanities, social sciences, and natural sciences books for general readers (*The MIT Press Essential Knowledge series*). The Stanford Encyclopedia of Philosophy, in which each entry is a contribution of many volunteer scholars, has been available free of charge on the Internet for the last 20 years (Zalta, 2006). In Korea, the popular educational comic series *Far-away Nations, Neighboring Nations*, by Professor Won-Bok Rhie, provides useful content for teenagers to understand world history

and culture. Some scientists have showcased their expertise through mass media (Jensen, Rouquier, Kreimer, & Croissant, 2008).

Social discussions on the public use of scientific knowledge are already underway. Since the publication of the Bodmer Report (Bodmer, 1985), socio-cultural changes in the public understanding of science have been steadily implemented. The European Commission-led Science and Society project has evolved into Science with and for Society, which has focused on the communication between scholars and other societal actors, such as citizens, policy-makers, and businesspeople (Owen, Macnaghten, & Stilgoe, 2012). The open-access movement has also allowed the public to freely access scholarly information (English, 2004).

In addition, the social Web environment, represented by Web 2.0, has provided channels for direct communication between scholars and the public. Use of various informal web-based channels have made personal and social communication among scholars more frequent and widespread (Sugimoto & Thelwall, 2013). In science communication, the outreach or popularization of science has been actively discussed with regard to publicizing science-related topics among non-experts. Similarly, science journalism has focused on communicating and explaining scientific knowledge to the public through mass media (Kyvik, 2005).

Despite ample evidence that scholarly information is publicly communicated, few studies have examined the use of scholarly information outside the scholarly community. Previous studies have only focused on

scholars' activities and interactions with the public within the science field. Assuming a relatively broader perspective, the present study seeks to identify scholars' informal communication activities and how these are used in public. In scholarly communication, informal communication is a concept that contrasts with formal communication through robust and reliable information such as scientific journals and books, and refers to communication with personal and social characteristics. We try to analyze communication activities between scholars and the public, which are rarely addressed in traditional scholarly communication studies, as a category of informal communication activities. This study defines the informal communication activities between scholars and the public as all public activities that convey the contents related to the scholar's research to the public. Also, when the activity of scholars was communicated to the public, it is regarded as public use. In this study, however, scholars were excluded from the concept of the public, and communication activities between scholars and scholars were excluded from the analysis because we focused on communication outside the academic community. We focus on social scientists' activities that are expected to be most closely related to public interest and use, especially by studying social phenomena and public life.

Therefore, the purpose of this study is to identify and categorize the contents and public use patterns of social scientists' informal communication activities. In order to collect informal communication activity data, we used Twitter data, which many studies have previously used, to grasp real-world communication

content (Mahrt, Weller, & Peters, 2014). The research questions of this study are as follows:

- RQ1. What are some types of informal communication activities of social scientists that the public mentions on Twitter?
- RQ2. What types of media do social scientists use to communicate, directly or indirectly, with the public?
- RQ3. What sectors of society do social scientists interact with outside the academic community?

2. Literature Review

2.1 Scholars' Communication with the Public

In an era wherein science has been immensely popularized, scholars have made various efforts to process and transmit their expertise, which was initially only shared within the academic community, in a form that is easily understandable by the public. Previous studies on scholars' communication with the public have focused on how science and technology research findings are communicated to the public. In particular, the interaction between scholars and the public has been mainly discussed through science journalism and popular science books (Bucchi & Trench, 2008). Science communication studies have tried to identify disciplines and contents that are frequently communicated through the news media, and the percentage of total news coverage (Bucchi

& Mazzolini, 2003; Schäfer, 2012; Vestergard & Nielsen, 2017). Scientometrics research, which uses journals to measure the research productivity of scholars, has also begun to consider using popular science books to measure research productivity (Kyvik, 1994).

As the scholarship of the digital age became newly defined, the public engagement activities of scholars began to be discussed in detail. Barker (2004) defines the five types of public engagement practices that characterize networking, collaboration, and communication between scholars and the public: public scholarship, participatory research, community partnership, public information networks, and civic literacy scholarship. Scanlon (2014) also identifies today's changed academic practices as open data, open publications, alternative publications, and open educational practices, and refers to this phenomenon as the public engagement of scholars. Particularly, in science and technology, efforts have been made to identify why public engagement is needed, which parties must cooperate, how to implement it, and when and where it should be implemented (Delgado, Lein Kjolberg, & Wickson, 2011; Dudo & Besley, 2016; Poliakoff & Webb, 2007; Stilgoe, Lock, & Wilsdon, 2014).

Nonetheless, research on scholars' communication with the public has been limited to science and technology fields. In addition, previous studies have mainly focused on the characteristics of academics who share information with the public, and there is a relative lack of consideration of how the information distributed by these scholars is utilized

in mass society.

2.2 Scholarly Communication and Social Media

Computer-mediated communication and Web 2.0-related technologies have particularly contributed toward promoting informal scholarly communication. Many studies have shown that scholars share and publish their research content through social media platforms such as social networking services (SNSs), blogs, and Twitter. The scope of these studies can be summarized in three points. First, some studies are related to the adoption of social media in scholarly communication and focus on reasons for using social media in academic communities, its usefulness in academia, and the characteristics of scholar groups adopting social media (Gu & Widén-Wulff, 2011; Nández & Borrego, 2013; Shehata, Ellis, & Foster, 2015). Second, some studies have focused on the information behaviors of scholars and revealed social media usage patterns; for example, there is research on how scholars distribute and cite information through blogs (Fausto, S., Machado, F. A., Bento, L. F. J., Iamarino, A., Nahas, T. R., & Munger, D. S. 2012); Shema, Bar-Ilan, & Thelwall, 2012) and how conference information is distributed through Twitter (Lee, Yoon, Smith, Park, & Park, 2017; Ross, Terras, Warwick, & Welsh, 2011). Third, there is a study on altmetrics that focuses on the use of social media in measuring the research productivity and impact of scholars (Haustein, Costas, & Larivière, 2015; Haustein, Peters, Sugimoto, Thelwall, & Larivière, 2014).

Despite substantial research on the use of social media in scholarly communication, most studies have focused on informal communication among scholars, while only a handful of studies have focused on interaction outside the academic community. According to a recent library and information science study (Kjellberg, Haider, & Sundin, 2016) that reviewed research on scholars' use of SNSs in the past decade, 10 per cent (8 out of 80) of all studies identified on this topic focused on scholars' outreach activities outside of the academic community. Most of these studies were limited to science and focused either on exploring scholars' perceptions of outreach activities (Colson, 2011; Thorsen, 2013) or strategies for and the usefulness of sharing and disseminating research findings among the public (Alegi, 2012; Cao & Yin, 2009; Kelly & Autry, 2013; Luzón, 2013; Mackenzie, 2013). For example, Colson (2011) explored scientists' perceptions on delivering research results to the public through science blogs, and Kelly and Autry (2013) identified strategies to popularize the practical use of open access journals in the public through a blog.

Until now, research on communication between academia and the public has been limited to science and technology and has explored the perception and usefulness of scholars rather than their communication activities. In addition, despite social changes such as communication technology developments and the popularization of science, scholarly communication research has still been limited to communication among scholars. The present study focuses on the informal communication activities of social scien-

tists, which have rarely been addressed even in the field of scientific communication. In particular, it attempts to identify the public's interest in scholars' informal communication activities by investigating the content and proportion of scholars' activities mentioned in public on Twitter.

3. Methodology

3.1 Data Collection

The data collection process consisted of two phases: searching for profile data of social scientists and identifying Twitter data showing the informal communication activities of the selected social scientists. In the profile data retrieval phase, the list of social scientists from the Korea Researcher Information (KRI) database (DB) was used for sampling frame. From the 22 social science fields identified by the KRI DB, we selected 5 social science fields—economics, law, sociology, psychology, and politics—that are widely known as major fields of social science and expected to be highly demanded by the public. The profile information of 5,036 Korean social scientists who belonged to any of the 5 social science fields was collected.

In the Twitter data identification phase, we traced tweets demonstrating the informal communication activities of the 5,036 social scientists. To filter the informal communication activities of social scientists on Twitter, we organized search queries in Korean (“OOO 교수” 법) based on the names and

subject areas of these social scientists (Pujari, Hadgu, Lex, & Jäschke, 2015). By using a query list consisting of the names and fields of the 5,036 social scientists, tweets were automatically collected through Java programming via the Twitter search page (<https://twitter.com/search-home?lang=ko>). The total number of tweets collected through the query list was 6,280 as of October 2016, mentioning 1,016 social scientists. We then conducted a pilot content analysis on the 6,280 tweets to remove irrelevant data and to identify concepts corresponding to our three research questions. As a result, we collected a total of 4,548 tweets that included informal communication activities between social scientists and the public. The collected tweet data covers the period from November 7, 2008, through October 15, 2016. The number of social scientists whose informal communication with the public was identified through tweets was 736, or 15 per cent of the sampling frame. The social scientists included 238 (32 per cent) economists, 177 (24 per cent) political scientists, 156 (21 per cent) legal scholars, 120 (16 per cent) sociologists, and 45 (6 per cent) psychologists.

3.2 Data Analysis

To identify and categorize the contents of the informal communication activities of social scientists and the usage patterns of the public, a content analysis was conducted on the Twitter data of the 736 social scientists. The analysis was performed by developing a coding scheme, conducting an inter-coder reliability test, and applying the final coding scheme to the

entire sample data. A total of 4,548 cases were analyzed using ATLAS.ti, a qualitative data analysis software, to maintain consistency in large-scale Twitter data analysis.

To develop the coding scheme, we first constructed three higher categories (i.e., informal communication activities, communication media, and cooperative sectors) corresponding to the three research questions. Then, using the open coding method, two coders repeatedly extracted and categorized the new concepts on informal communication activities between social scientists and the public using their tweet content. In the coding process, we used two types of extrinsic information (i.e., link information and bookstore topic codes) to better understand the context of the tweets. For example, if the link included in the tweet provided additional information related to the conference, we conducted content analysis with reference to the related information. In addition, to analyze the subject matter of the books written by the social scientists, we used the topic codes provided by Aladdin, a popular bookstore in Korea. During the entire coding process, multiple coding was allowed if more than one concept existed. The coding process was closely reviewed twice. Thus, we identified 104 codes relating to informal communication activities between social scientists and the public.

To ensure reliability, an inter-coder reliability test was conducted on 10 per cent (n=455) of the 4,548 quotations. Using Holsti's formula (Holsti, 1969, p. 137), the inter-coder reliability was found to be 0.88. Through this agreement procedure, a minor revision was made to the initial coding scheme. As a result,

38 codes in 9 categories were found to correspond to RQ1 (informal communication activities), 22 codes in 5 categories to RQ2 (communication media), and 13 codes to RQ3 (cooperative sectors).

Lastly, by using the newly revised coding scheme, we reformed the final coding with the entire sample. The final coding result was exported to a Microsoft Excel file as a code-document cross-tabulation; it contained the frequency of codes across documents, using the analysis function of ATLAS.ti. Based on the processed data, we conducted a correspondence analysis to understand the statistical distribution of the informal communication activities of social scientists and public use patterns.

4. Results

4.1 Types of Informal Communication Activities of Social Scientists and Public Use

- RQ1: What are some types of informal communication activities of social scientists that the public mention on Twitter?

The types of informal communication activities among social scientists and the public were revealed in 38 codes in 9 categories (see Table 1). Among them, the most prominent activities are related to scholars expressing their opinions as experts in mass society (giving expert opinion, 38 per cent). For ex-

ample, scholars have been providing expert opinions to the public through various channels, particularly by publishing columns in the mass media or making comments through media interviews. In some cases, the comments of scholars in conferences or writings have been quoted in the news media and communicated to the public. Some scholars have expressed opinions in panel discussions as panelists or presenters and have also been involved in writing book reviews.

Next, the activities of social scientists which have received considerable public attention include criticizing or commenting on social phenomena. In particular, the results reveal that social scientists played a role in providing the public with a basis for judging specific issues by sharing critical opinions with them in relation to political and social issues. For example, the activities of political scientists commenting on social issues are being shared by the public, as shown in the following tweet.

Persuasive diagnosis! RT @OOO: Reason for comment manipulation on Twitter: Professor OOO of the Department of Political Science and Diplomacy at OO University said, **'The National Intelligence Service must have launched a psychological war on Twitter for the "contamination effect".'** (POL_0368)

In addition, social scientists also interacted with various people outside the university and made educational contributions. They mainly provided liberal arts education to the general public, which is useful for developing civic qualities in society, and they

〈Table 1〉 Types of informal communication activities of social scientists and public use

Type of informal communication activity	No. of tweets (%)	
Giving expert opinion	Giving feedback through an informal channel	847 (10.4)
	Contributing a column	612 (7.5)
	Media interview	612 (7.5)
	Quoted by news media	468 (5.7)
	Participating in a panel discussion	383 (4.7)
	Participating in the debate as a speaker	149 (1.8)
	Contributing a book review	11 (0.1)
	Subtotal	3,082 (37.8)
Criticizing social phenomena	Political criticism	554 (6.8)
	Social system criticism	531 (6.5)
	Societal criticism	317 (3.9)
	Policy criticism	280 (3.4)
	Subtotal	1,682 (20.6)
Commenting on current issues	Socio-economic situation	403 (4.9)
	Social issue	294 (3.6)
	Policy	115 (1.4)
	Subtotal	812 (10.0)
Engaging in public lectures	Civic education	453 (5.6)
	Professional group education	98 (1.2)
	Providing expertise	92 (1.1)
	Lifelong education	52 (0.6)
	Subtotal	695 (8.5)
Educational contributions	Offering liberal arts	239 (2.9)
	Recommending useful information	105 (1.3)
	Providing insight into social phenomena	105 (1.3)
	Arousing intellectual stimulation	84 (1.0)
	Providing educational advice to the public	29 (0.4)
	Participating in educational administration	22 (0.3)
	Interpreting history	15 (0.2)
	Subtotal	599 (7.3)
Policy/social participation	Policy participation	278 (3.4)
	Social participation	144 (1.8)
	Political activity	132 (1.6)
	Participation in legislative debate	40 (0.5)
	Subtotal	594 (7.3)
Writing	Popular science book	358 (4.4)
	Academic paper	73 (0.9)
	University text book	65 (0.8)
	Subtotal	496 (6.1)
Informal research activity	Organizing research meetings	61 (0.7)
	Presenting research results	45 (0.6)
	Presenting theoretical perspectives	18 (0.2)
	Advising on research	17 (0.2)
	Subtotal	141 (1.7)
Facilitating discussions	Host of a TV debate	29 (0.4)
	Facilitator of the debate	22 (0.3)
	Subtotal	51 (0.6)
Total	8,152 (100.0)	

Note: The descriptive statistics are based on the content analysis of the tweet sample (N=4,548) using multiple coding.

also conducted vocational education for professional groups (civil servants, businesspeople, journalists, or legal professionals). The following tweet shows an activity in which an economist offered classes on basic income to citizens. Such civic education is related to the transformation of civic consciousness and moving behavior in a value-oriented direction.

<Wednesday lecture series> entitled **'discuss basic income'** of Professor OOO 2/24 (Wed.) <http://bit.ly/bVOEPN> Please RT for those interested.
^ ___ ^ #seminarmsg #Economy # **Solidarity for Human Rights** (ECO_0002)

Another type of activity of social scientists that attracted public attention was engaging in policy-related activities and participating in various forms of social activities (policy/social participation, 7 per cent). These included social scientists evaluating and consulting policies, working with civic groups to voice on social issues, engaging in political activities, and participating in legislative debates, as follows.

<<< The Topic of **the 2012 Presidential Elections**-Economic Democracy >>> <http://durl.me/2qktuo?> **The Democratic United Party's policy** was to amend the "Economic Democracy Provision"!.. **Professor OOO prepared the foundation.** (ECO_0105)

[Asking legal scholars **about 'Chung Bong Ju Law'**] As of 2:13 pm, **Professor Kim is currently**

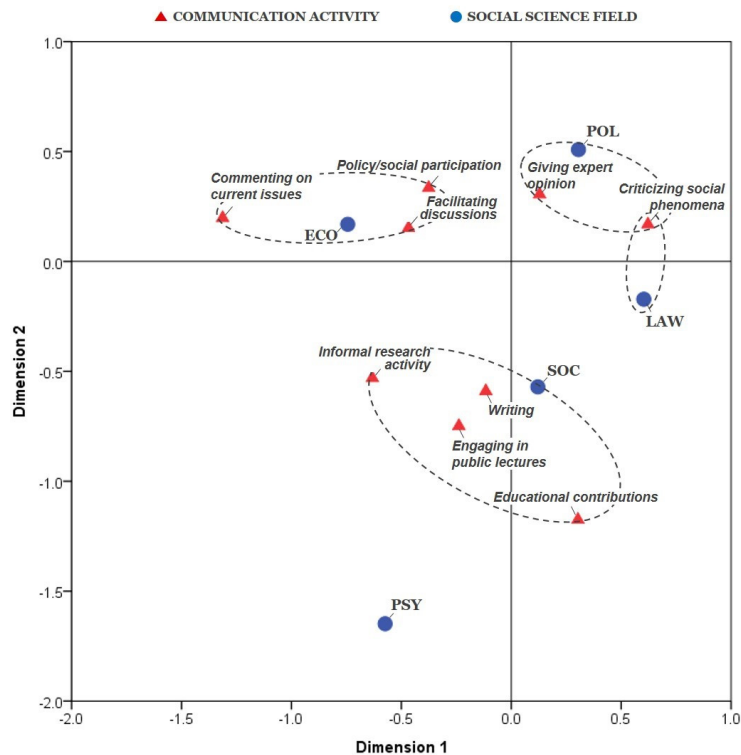
speaking at the National Assembly Hall No. 128. <http://twitpic.com/8kjfcj?> (LAW_0181)

The subjects of the writing activities of social scientists that attracted public attention varied. The results of topic analysis and correspondence analysis of the popular science books (n=441) identified from the sample tweets data showed that 'social criticism/column' was the most common topic in the writings of social scientists (79 cases, 18 per cent). In contrast, other topics were published in correspondence with specific social science fields. For example, the next major topic was 'general sociology', which was mainly published by sociologists (54 cases, 12 per cent). Similarly, political scientists were publishing books on the topics of 'political situation/political history' (52 cases, 12 per cent) and 'political criticism/column' (30 cases, 7 per cent). The topics of the books published by economists included 'economic history/economic outlook' (49 cases, 11 per cent), 'economic policy/economic criticism' (48 cases, 11 per cent), 'economic theory/economic thought' (35 cases, 8 per cent), and 'economic stories' (26 cases, 6 per cent). In the case of legal scholars, it was revealed that they write books on topics related to 'self-improvement' (44 cases, 10 per cent) and 'legal stories/legal professional stories' (26 cases, 6 per cent). Although relatively small, public interest in the informal research activities of social scientists was also revealed. Such activities include organizing research meetings such as academic societies, presenting research results, presenting theoretical perspectives, and advising on research.

Other activities that attracted public attention were facilitating discussion programs or programs on current affairs.

Figure 1 summarizes how the top categories of scholarly informal communication activities with the public appear in correspondence with the social sciences. In the field of economics, activities related mainly to policy and current affairs (policy/social participation, commenting on current issues, facilitat-

ing discussions) were prominent. Sociologists can be identified by activities related to public education and research (engaging in public lectures, educational contributions, writing, informal research activity). In communication activities related to social phenomenon criticism, scholars of politics and law were involved. In addition, political scientists were actively engaged in activities to present opinions as experts.



<Figure 1> Types of informal communication activities corresponding to five social science fields

Note: In this map, the abbreviations of the social science fields are as follows: POL, politics; ECO, economics; SOC, sociology; PSY, psychology; and Law. A correspondence analysis was conducted for the combinations of the five social science fields and informal communication activities resulting from the content analysis of the tweet sample (N=4,548). The two dimensions account for 93 per cent of the total variance in the data.

4.2 Social Scientists' Communication Media with the Public

- RQ2: What types of media do social scientists use to communicate, directly or indirectly, with the public?

The media used by social scientists to communicate directly or indirectly with the public were identified as 22 items in 5 categories (see Table 2). Of them, mass media (49 per cent), especially newspapers (25 per cent), accounted for the largest portion. Broadcasting, including TV, radio, and internet broadcasting, also accounted for 20 per cent of the total. Taken together, newspapers and broadcasting accounted for 44 per cent of the total communication media between social scientists and the public. Although relatively small, magazines and cultural content also appeared as mass media types. The following three tweets illustrate how social scientists have communicated with the public through communication media called TV program, newspaper, and cultural content:

In the (MBC) 100 Minute Discussion, Professor OOO is talking about the fact that Roh Moo-hyun can not accept conflicts because he is proud of himself as an absolute good, and Lee Myung-bak can not tolerate conflict because he thinks conflicts hinder efficiency. The future president should be able to adjust the conflict through politics. It sounds like a good word. (POL_0048)

Professor OOO "If the other person likes me, what is the psychology that you do not like?" <TV Daily> <http://newslink.media.daum.net/mobile/20120403070406859?...> (PSY_0482)

Cho Yong-pil's composition and **Professor OOO's lyrics** at the Department of Sociology of OO University. The song, "One day, on my way home" was born as a result of the meeting with Singer Cho and Professor OOO. The song calmly releases the solitude and pain of those exhausted in Korean society through Cho Yong-pil's weighty vocals, and is seen as a "healing song" that comforts the hard times. (SOC_0009)

Interestingly, social scientists were shown to interact in society through various channels related to politics. In addition to participating in various policy debates, the results also revealed their active participation in political activities through political parties and think tanks. They communicated with the public through advocacy groups or policy seminars. They also interacted with popular societies through government agencies and, in rare cases, stated their positions in the form of statements on political issues. The media used most often by the public to obtain educational and informational content from social scientists were public lectures and popular science books. On the other hand, there was relatively little public interest in scholarly content delivered via social media. In other words, the public showed preference for formal channels such as newspapers, TV, and books to receive informational content regarding social scientists' activities.

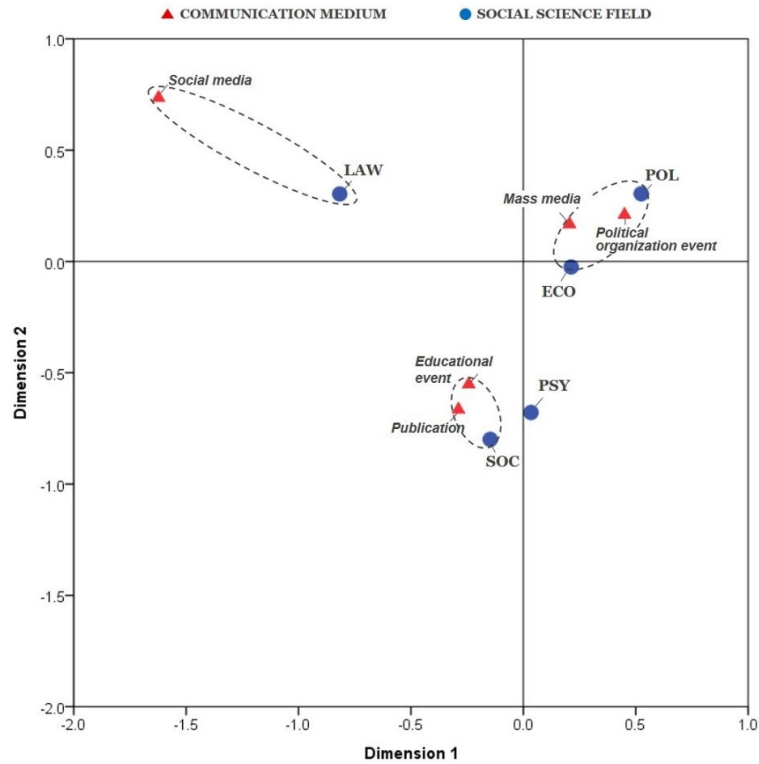
〈Table 2〉 Communication media types between social scientists and the public

Type of informal communication medium	No. of tweets (%)	
Mass media	Newspaper	1,051 (24.7)
	TV	349 (8.2)
	Radio	272 (6.4)
	Magazine	218 (5.1)
	Internet broadcasting	209 (4.9)
	Cultural content	2 (0.0)
	Subtotal	2,101 (49.3)
Political organization event	Policy debate	301 (7.1)
	Political party/think tank	225 (5.3)
	Advocacy group	70 (1.6)
	Policy seminar	58 (1.4)
	Government agency	50 (1.2)
	Public statement	15 (0.4)
	Subtotal	719 (16.9)
Educational event	Public lecture	449 (10.5)
	University lecture	108 (2.5)
	Academic conference	43 (1.0)
	Subtotal	626 (14.7)
Publication	Popular science book	441 (10.3)
	Academic paper	74 (1.7)
	Research report	26 (0.6)
	Subtotal	541 (12.7)
Social media	Social networking services (SNSs)	187 (4.4)
	YouTube	54 (1.3)
	Blog	34 (0.8)
	Subtotal	275 (6.5)
Total	4,262 (100.0)	

Note: The descriptive statistics are based on the content analysis of the tweet sample (N=4,548) using multiple coding.

Figure 2 shows the results of the correspondence analysis, indicating some relationships between informal communication media and social science disciplines. On the left side, two different clusters can be seen. One is that social media has been identified in correspondence with the law domain, indicating that legal scholars are more likely to use social media. The other is the fact that media in the form of publications and educational events have been iden-

tified in correspondence with sociology. This result is consistent with the result that sociologists are primarily associated with writing and informal research activities, as depicted in Figure 1. On the right-hand side, mass media and political organization events were identified together with economics and politics. This means that economists and political scientists are more likely to communicate with the public mainly through mass media or political organization events.



<Figure 2> Types of informal communication media corresponding to five social science fields

Note: A correspondence analysis was conducted for the combinations of the five social science fields and communication media resulting from the content analysis of the tweet sample (N=4,548). The two dimensions account for 97 per cent of the total variance in the data.

4.3 Sectors Cooperating with Social Scientists

- RQ3: What sectors of society do social scientists interact with outside the academic community?

From the informal communication activities of social scientists, a total of 13 cooperative sector types were found outside of academia (see Table 3). Most

of all, social scientists showed various forms of interaction with journalists through broadcasting debate programs or public lecture programs, interviews with news media anchors, or even appearances on cultural program panels. In particular, social scientists who cooperated the most with journalists included political scientists (254 cases) and economists (227 cases), accounting for two-thirds of the cases (n=724) of collaboration between social scientists and journalists. Interestingly, social scientists who cooperated the

<Table 3> Sectors cooperating with social scientists

Cooperative sector	No. of tweets (%)
Journalist	724 (28.6)
Non-government organizations (NGOs) / Non-profit organizations (NPOs)	309 (12.2)
Political party	275 (10.9)
Legislator	271 (10.7)
Education sector	223 (8.8)
Policy research think tank	175 (6.9)
Government and public institution	166 (6.6)
Research institute sector	128 (5.1)
Judicial officer	92 (3.6)
Business sector	73 (2.9)
Popular culture sector	65 (2.6)
Publishing sector	21 (0.8)
Medical sector	10 (0.4)
Total	2,532 (100.0)

most with businesspeople were economists, accounting for an overwhelming 68 per cent (50 out of 73).

While in most cooperative sectors, cooperation with scholars from specific fields was predominant, the share of cooperation with non-government organizations (NGOs) and non-profit organizations (NPOs) was similar among the social scientists—legal scholars (84 cases), sociologists (81 cases), economists (74 cases), and political scientists (67 cases), and —except for psychologists (3 cases). Sometimes, collaborations with social scientists in a single event have been presented in various types. For example, as shown in the following tweet case, a legal scholar (LAW_0235) has cooperated with a NGO (Public Interest Law Center), judicial officers (former judge, attorney), and a popular culture sector (gagman).

Professor OOO, director of our **Public Interest Law Center**, will appear in the “Judicial Reform Talk Concert” with **former judge**, XXX. February 27 at 7 pm. **gagman** □□□, panelist △△△, **attorney** ◇◇◇ will appear! pic.twitter.com/CgX35eFL (LAW_0235)

5. Discussion

The previous discussions about research activities and public use of scholars have been mainly dealt with in the field of science focusing on the public understanding of science. Such studies focus on exploring how science and technology research achievements are reported to the public. For example, there are many studies that have content analyzed the science coverage in the newspapers or TV programs (Dearing, 2016; Pellechia, 1997; Vestergard & Nielsen, 2017).

There is also a content analysis study that examines how scholarly achievements are used in the public world by grasping the extent to which major science concepts (DNA) in textbooks are quoted in mass media (Ko, 2011). However, the previous studies are limited to science. In addition, these studies focus on the content of information that is distributed rather than the behavior and usage of information, making it difficult to understand the extent to which scholarly research activities can be used in the public societies.

In this study, we investigated the social science field that has been neglected in scholarly and public communication researches, despite the fact that the nature of research is societal and it has more contact with the public. In addition, this study is different from the previous studies in that it focuses on contents that interact with scholars and the public. Specifically, this study identified what social scientists in five fields were doing outside academia, communicating with the public through which informal communication medium, and collaborating with people in what fields outside of academia.

In scholarly communication, research on informal communication has mainly focused on identifying what kind of informal channels (postal or computer-based mailings) are used in scholarly communities and how scholars are connected one another (Case & Given, 2016). On the contrary, this study examines how scholars' groups communicate with mass society outside academia, what kind of communication channels they have, and what kind of activities they are engaged in. We grasped the contents

of informal communication activities of social scientists in real world and grasps how actual public use is being done.

Methodologically, this study attempted to explore various research activities that reflect detailed characteristics of each field by quantitative and qualitative approach to informal research activities of social scientist. Specifically, using the Twitter data, we could quickly collect large amounts of information reflecting public's reaction information and real-world communication, which can not be grasped by questionnaires or interviews. Data collection through Twitter can capture various types of informal communication activities that have not been recognized or exposed to the outside world. For example, we have identified that a sociologist wrote lyrics for a popular song depicting a social world. Also, it is meaningful that our method of analyzing the activity on the Twitter presented a new research method in informal communication research in that it captured the activity of the subject naturally through a kind of unobtrusive method.

6. Conclusion

This study identified the content of social scientists' informal communication activities with the public by analyzing Twitter data and classified the content into three categories (i.e. informal communication activities, communication media, cooperative sectors) (see Table 1, 2, 3). By identifying and analyzing the scholarly activity messages that have been men-

tioned by the public on Twitter, we were able to identify the areas and content of exchanges with the public among the research activities of social scientists. In particular, we revealed aspects of the informal communication activities of social scientists and identified how the public uses the activities in the real world.

According to the results of this study, the most prominent informal communication activities of social scientists were to express opinions about their specialties, critique social phenomena, or comment on current issues. Other activities that were highlighted include engaging in public lectures, educational contributions, policy/social participation, and writing represented by popular science books. Next, mass media accounted for nearly half of the communication media with which social scientists and the public communicated. Interestingly, political organization events such as policy debates, political parties, and think tanks were also noticeable. In addition, some social scientists were found communicating with the public through educational events, publications, and social media. Last, the collaborative sectors who communicate with social scientists in mass society were mainly journalists, NGOs/NPOs, and political parties.

This study broadened the scope of scholarly communication by advancing the understanding of informal communication activities between social scientists and the public. It is especially significant because it identified social scientists' informal communication activities based on the interest of the public.

7. Limitations and Directions for Future Research

Since this study used only the activity data of scholars available on Twitter to investigate informal communication between the scholars and the public, communication activities not expressed through tweets were not reflected. For example, the frequency and proportion of informal communication activities can vary depending on the distribution and usage patterns of domestic Twitter users and the characteristics of scholars selected as samples. In this regard, it is necessary to study similar sample sizes of social scientists in the same field at different times or in different countries in the future. Nevertheless, this study is meaningful in that it explored informal communication between social scientists and the public, which was not previously revealed in scholarly communication using bottom-up approach, and identified the types of informal communication activities, communication media, and collaborative sectors in detail. In particular, by looking at the proportion of activities mentioned in public on Twitter, we were able to grasp the extent of public interest in the informal communication activities of scholars.

This research can be used as the basis for preparing questionnaire items for surveying all social scientists in the future. It is also possible to conduct research using social media other than Twitter to investigate the public reaction to informal communication by social scientists outside academia. The results of this study can be used as empirical data to grasp the demand for humanities and social sciences information services

and to prepare relevant policies in institutions that provide civic education and information services, such as national information service institutions, libraries, bookstores, and cultural centers.

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