



TIME - SERIES ANALYSIS ON MASS MEDIA REPORT AND UTILIZATION ANALYSIS ON SOCIAL MEDIA - CASE OF LOCAL RAILWAY -

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Abstract: In Japan, many local railway companies have serious problems: passenger decrease and motorization. In addition, some of them have been encountered the crisis of bankruptcy. However, they make an effort to operate for not only passengers but also cities. How has mass media reported the fact? The information provided by mass media is important to make public opinion. Also, with the development of internet, it has become easier to spread an individual opinion by social media. Especially, social networking service: SNS, is already recognized as an effective way. In this study, first of all, mass media report of local railway is analyzed. Then, utilization of social media related to the railway is clarified.

Keywords: Local railway; Mass media; Social networking service; Text mining

INTRODUCTION

In Japan, passenger decrease in local railway has been continuing in the long due to fewer children and motorization: the number of passengers decreased 17% since 1987. Many local railway companies have been struggling; for example, although the number of employees decreased 28%, 76% of companies have a huge debt and faces bankruptcy. It is said that some of them have a difficulty to do a minimum safe maintenance [1]. Under this situation, these companies have made an effort to manage: implementing a promotion of utilization, holding an event for local development with a local government and residents. However, how did a mass media report these facts? Newspaper and TV have a great power to change public opinion. According to the investigation [2], the percentage of readers of newspaper (morning paper) is 77%, and the percentage of those who refer a paper when making an opinion about an incident is approximately 50%.

In the utilization of social media, with the development of internet technology, it has become easier to spread individual's opinion. The percentage of users of internet is 82.8% in 2013 [3], and it will increase in the future. Especially, SNS: Social Networking Service, such as Facebook and Twitter, new social media, the number of users has been dramatically increasing. It can be possible to communicate among users and to spread information easier; in short, its function is different from weblog and website. It is expected to use an efficient and effective information and

communication way of city development [4]. In the report of how to support a local railway in the future, it is concluded that utilizing such a social media is an effective way to inform to visitors [5].

Hence, the objective of this study is to analyze mass media reports related to local railway in chronological order and utilization of social media presently.

TIME-SERIES ANALYSIS ON MASS MEDIA REPORT

Case Study

This chapter analyzes the tendency of mass media report related to Tarumi railway. This railway company was built in 1984, transformed from Tarumi line, a line in Japan National Railways, because of low passenger density and so on. At first, the company operated in the black because of the sector of freight transport. However, the amount of freight transport decreased; finally, it was abolished in 2005. In the sector of passenger transport, most of them are student. The number of passengers has decreased due to fewer children (Figure 1). Therefore, the company operates in the red, and five local governments along the rail line compensate it.

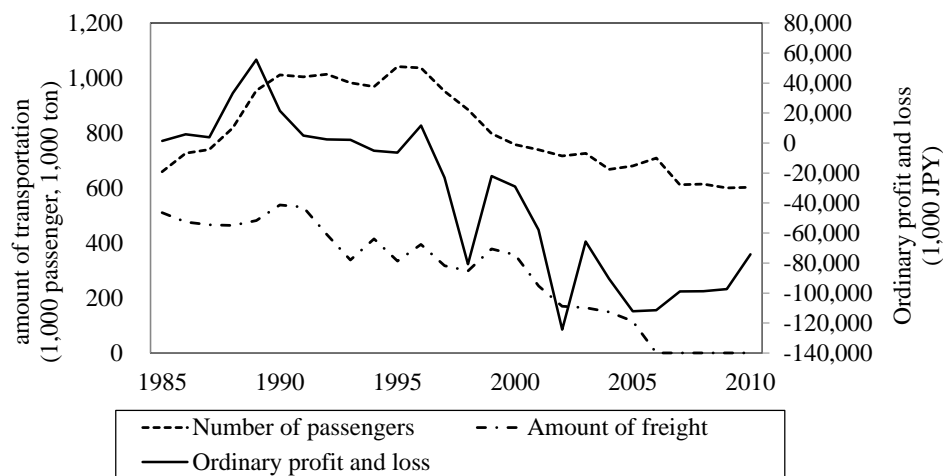


Figure 1. Changes in amount of transportation and ordinary profit and loss

DATA COLLECTION

The data for analysis are Chunichi Shimbun. This Shimbun has the most readers in Gifu prefecture: according to Yomiuri company website, the readers' share from July to December in 2012 is Chunichi Shimbun: 52.3%, Gifu Shimbun: 23.4%, Asahi Shimbun: 7.8% and others: 16.5%, respectively. The period of analysis is approximately 20 years, from January 21st, 1991 to December 11th, 2012. Data were collected by Chunichi Shimbun digital database system. This system can be used in public library. As the result of extracting the articles including the word "Tarumi railway", 667 articles were collected.

METHODOLOGY

IBM SPSS Text Analysis for surveys, an application for text mining was used in this study. It can automatically input and analyze text data from various viewpoints: part of speech, meaning of expression, name of location and institution and so on. First of all, changes in the number of article related to Tarumi railway was aggregated. Then, frequent expressions in the article were grasped. On the basis of the result, expressions which a reader can predict the contents of article were selected. Finally, what kind of articles mass media reported in the past twenty years was clarified.

RESULT

Figure 2 shows changes in the number of articles including the words “Tarumi railway”: number of articles is 667. This bar graph has four peaks, 1991, 1995~1996, 2003~2006, and 2010. Especially, the peak in 2003 is the greatest than other peaks.

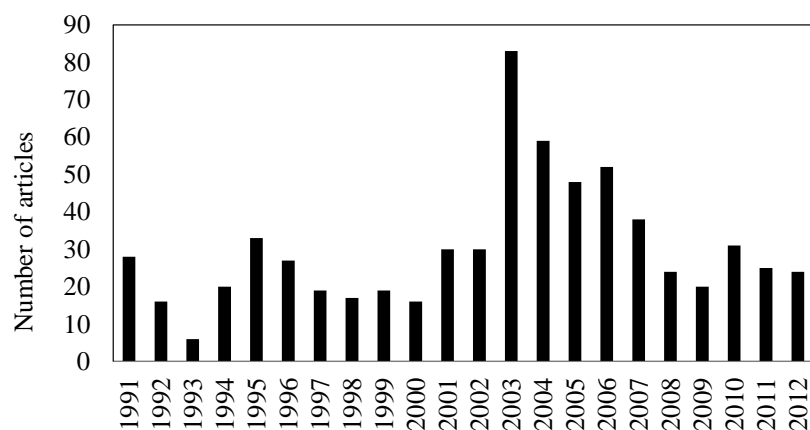


Figure 2. Changes in articles related to Tarumi railway

Rank table of frequent expressions in each viewpoint is shown in Table 1 and Table 2. As a result of be referred articles including these expressions, following facts were revealed.

- Many of the articles including “harsh”, “deficit”, and “burden”, negative expressions and “subsidy”, positive expression, were the contents of business condition.
- Many of the articles including “enjoy”, positive expression, were the contents of train events and local sightseeing resources.
- Many of the articles including “usage”, noun, were the contents of mobility: for example, promotion of utilization, students commute, and vulnerable peoples’ usage such as elderly.

- Many of the articles including “safety”, positive expression, were the contents of traffic safety event; for example, the event of safety train operation, held by Tarumi Railway Company.
- Many of the articles including “crashing”, negative expression, were the contents of traffic accident.
- “Train”, “One’s train”, “along”, and “operation”, nouns, verb, the name of location, the name of institution, and “open”, good expressions had various types of contents.

Considering the above facts, the tendency of articles is divided into four viewpoints: “business condition”, “event”, “sightseeing resources”, and “mobility”. The reason of why “crash” was not focused is that most of the articles were about the fact of traffic accident.

Table 1. Rank table of frequent expressions in each viewpoint (1)

Rank	Noun		Verb		Name of location	
1	railway	144	exist	300	Motosu city	320
2	one's train	137	become	237	Gifu Pref.	170
3	along	122	say	189	Ogaki city	80
4	operation	116	make	173	Gifu city	50
5	usage	105	tell	155	Aichi Pref.	26

Table 2. Rank table of frequent expressions in each viewpoint (2)

Rank	Name of Institution		Positive expression		Negative expression	
1	Tarumi Railway	396	enjoy	54	harsh	64
2	Third-sector company	56	open	41	deficit	59
3	Local government along a railway line	49	subsidy	21	burden	26
4	NPO	37	surplus	20	crashing	22
5	Nagaragawa Railway	35	safety	17	suffer	19

The expressions to extract articles related to above viewpoints are shown in Table 3. Although the column “business condition” has frequent expressions, the columns of

“enjoy” and “sightseeing resources” do not have frequent expressions because it was difficult to extract only the words. Therefore, the name of event train and sightseeing resources were selected as an alternative expression. The columns of “mobility” was same reason; “promotion of utilization”, “students commute”, “high school student” and “elderly” were selected as an alternative expression.

Table3. Expressions to extract reports related to the article of each viewpoint

Category	Expressions included in the report	Number of articles
Business condition	deficit, burden, harsh, suffer, subsidy, and surplus	374
Event	event train, gourmet train, healthy train, casserole train, herb train, Ayu dish, and traffic safety event	188
Sightseeing resources	cherry, hot spring, and persimmon	197
Mobility	promotion of utilization, students commute, high school student, and elderly	194

Changes in above contents are shown in Figure 3 ~ Figure 6. The number of articles related to “business condition” is much greater than others. At the same time, its tendency is similar to all the articles one, in Figure 2. Therefore, what mass media reported in the period of four peaks, 1991, 1995~1996, 2003~2006, and 2010 is examined in following subsection.

First period (1991)

There are some articles of deficit in Figure 3; however, they are about the situation of other local railway companies in Chubu area. Most of the articles related to Tarumi railway are good news; for example, persimmon and cherry trees which are sightseeing resources, and the train event of Ayu, a Japanese fish. There are shown in Figure 4 and Figure 5.

Second period (1995~1996)

As shown in Figure 3, the number of articles related to business condition spikes upward. One of the reasons is that Tarumi railway had an ordinary loss for the first time in the era; however, most of articles are the business condition of other railway companies in Chubu area. Many of the articles related to Tarumi railway are good news; for example, event train of medical herb health and the event of sightseeing



resources.

Third period (2003~2006)

The number of articles related to Tarumi railway, in 2003 and 2004, is the greatest in the twenty period. As Figure 3 and Figure 6 are shown, “business condition” and “mobility” are also similar trend. In the articles of business condition, many of them are about discussion of abolishment of the company due to harsh business operation, inauguration of supporting group, and promotion of utilization. The content is as follows.

- In the fiscal year 2002, Tarumi railway had a largest-ever deficit operation. Since residents along the rail experienced the abolishment of other local railway, Nagoya TetsudoTanigumi line which was also located around the area, in 2000; therefore, in order to prevent further abolishment of local railway, some of the residents established the institution to support Tarumi railway. Then, the institution started some activities: collecting signatures to demand local governments, along the rail, to support financial aid, and changing a crosstie as a volunteer and so on. Finally, beginning 2005, these local governments started to compensate the company’s deficit.

In the contents of mobility, many of them are related to the matter of survival: for example, railway is important for children and elderly.

Fourth period (2010)

From 2003, the number of whole articles related to Tarumi railway decreases. However, in 2010, it spikes again. As Figure 3 and Figure 6 are shown, the tendency of the articles related to business condition and mobility is similar to whole number of articles (Figure 2).

Many of the articles of business condition were the discussion of that whether local governments stop to compensate or not. One of the reasons was some governments hesitate to continue. As a result, it was concluded that they continue to compensate until fiscal 2011 (However, even now, 2015, they still compensate it).

In the articles of mobility, many of them are related to children and elderly; its tendency is similar to third period. On the other hand, there is few articles of residents’ activity.

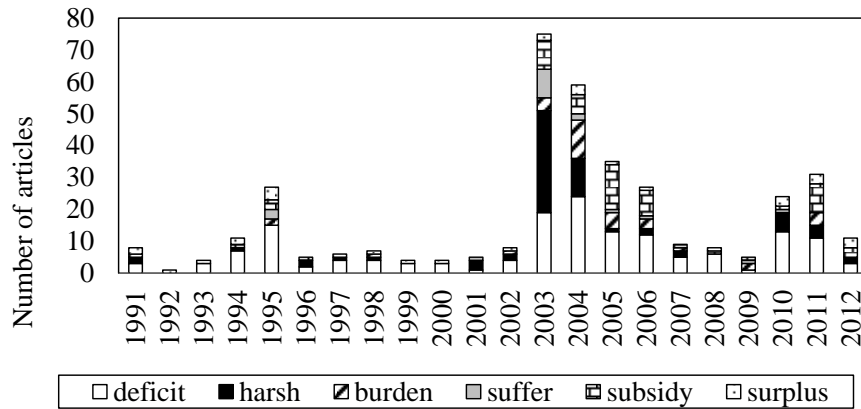


Figure 3. Changes in articles related to business condition

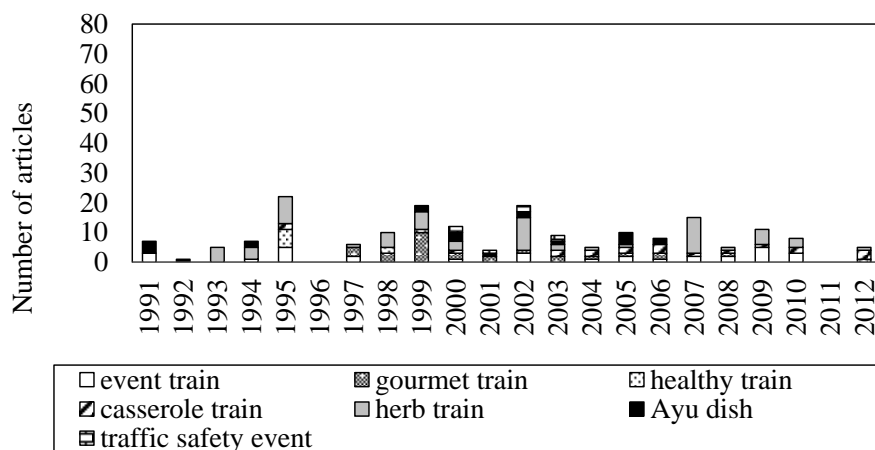


Figure 4. Changes in articles related to event

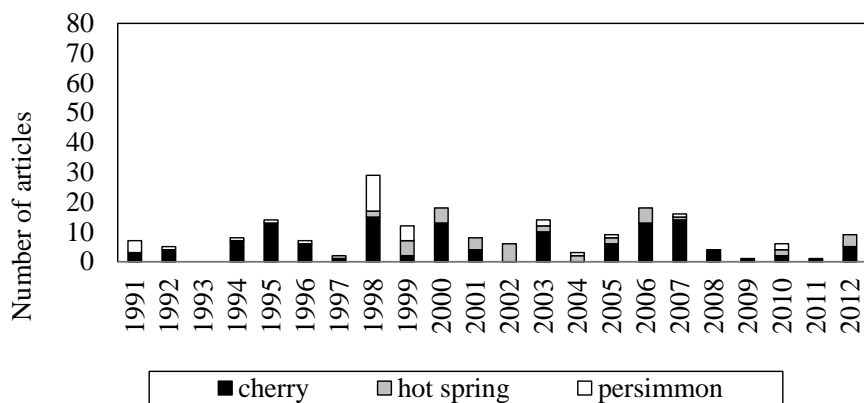


Figure 5. Changes in articles related to sightseeing resources

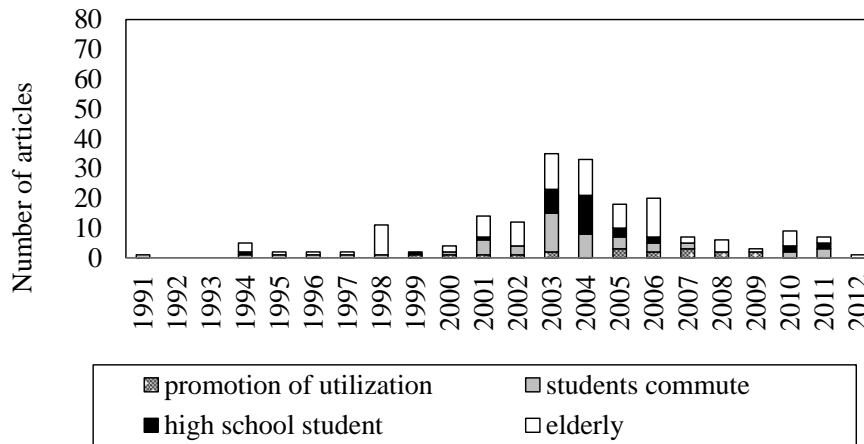


Figure 6. Changes in articles related to mobility

ANALYSIS OF UTILIZATION OF SOCIAL MEDIA METHODOLOGY

In this chapter, utilization of Twitter, a representative social media tool, is analyzed. After extracting the accounts related to local railway, the characteristic of accounts: number of tweet and the number of followers are grasped. Then, on the basis of some popular local railway accounts, followers' attribute is clarified. Such a method is already be used as a marketing strategy. In this study, two applications are used. One is Social Insight [6], provided by User Local, Inc. This tool offers the aggregated data of followers' gender, age, and living place in each account. Another is KH-coder [7]. This is a free software, and it has the function of text mining. In order to grasp the followers' characteristic on the basis of keywords in each follower's profile, co-occurrence network is developed. It is a network model, connecting related keywords.

RESULT

Utilization of social media

The result of utilization of Twitter accounts related to local railway is shown in Table 4. The columns of "management", "frequency of tweet", "picture", and "communication" in the table are evaluated by us. The number of tweet, follow and follower are checked on August 25th, 2015.

Table4. Twitter accounts related to a local railway

No.	Related Railway company	Management	Frequency of activity						URL
			Frequency of tweet	Picture	Communication	Number of tweets	Number of follows	Number of followers	
1	Aomori Tetsudo	unofficial	1	1	1	0	0	95	https://twitter.com/Arrsk
2	Sanriku Tetsudo	Official	3	3	1	3,358	30	8,062	https://twitter.com/santetsu_kun
3	Sanriku Tetsudo	unofficial	1	1	1	0	1	24	https://twitter.com/sanriku_t
4	Akita Nairiku Jukan Tetsudo	unofficial	3	3	1	13,137	648	1,230	https://twitter.com/AIZU_AT301
5	Konan Tetsudo	unofficial	3	1	1	46,296	504	331	https://twitter.com/EASTJAPANRAIL
6	Yamagata Tetsudo	Official	3	2	1	1,997	4	3,228	https://twitter.com/yr880
7	Yamagata Tetsudo	Official	3	3	3	7,755	5	5,942	https://twitter.com/yr_mochii
8	Yuri Kogen Tetsudo	Official	3	3	3	1,632	548	4,099	https://twitter.com/yuri_tetsudou
9	Tsugaru Tetsudo	Official	1	3	3	29	672	2,167	https://twitter.com/tsutetsu
10	Noto Tetsudo	Official	3	2	3	8,009	3,515	3,458	https://twitter.com/nototetsu
11	Manyo Sen	Official	3	2	1	1,873	0	1,905	https://twitter.com/Manyosen
12	Kashima Rinkai Tetsudo	Official	3	3	2	9,615	311	4,835	https://twitter.com/rintetsu_karin
13	Yagan Tetsudo	Official	3	2	3	1,452	24	2,366	https://twitter.com/yagan_railway
14	Isumi Tetsudo	unofficial	3	3	3	85,628	1,712	1,854	https://twitter.com/app_isumirail
15	Isumi Tetsudo	unofficial	3	3	3	55,939	198	266	https://twitter.com/soychicken
16	Hiachimaka Kaihin Tetsudo	unofficial	3	3	3	14,772	6,403	6,097	https://twitter.com/keha601
17	Choshi Denki Tetsudo	unofficial	3	1	1	248,893	3,936	3,570	https://twitter.com/t_togawabot
18	Echizen Tetsudo	Official	3	2	1	1,649	43	3,851	https://twitter.com/echizenrail
19	Tarumi Tetsudo	unofficial	3	3	1	5,056	1,704	1,597	https://twitter.com/tarutetuuiu
20	Tarumi Tetsudo	Official	2	1	1	236	66	1,764	https://twitter.com/tarumi_railway
21	Tarumi Tetsudo	unofficial	3	3	3	10,139	430	431	https://twitter.com/taru_q_s
22	Wakayama Denki Tetsudo	Official	3	3	1	6,863	1	54,761	https://twitter.com/ekichoTAMA
23	Ichibata Densha	Official	3	2	1	839	6,208	6,284	https://twitter.com/ichibatadensya
24	Nishikigawa Tetsudo	unofficial	3	3	1	1,912	1,939	1,577	https://twitter.com/Seiryu_Sen
25	Tosa Kuroshio Tetsudo	unofficial	3	1	1	432	174	450	https://twitter.com/npo_gonasen
26	Tosa Kuroshio Tetsudo	Official	3	1	1	2,178	231	1,776	https://twitter.com/tosakuro_train
27	Satsuma Orange Tetsudo	unofficial	1	1	1	0	0	10	https://twitter.com/nov333
28	Matsuura Tetsudo	Official	1	1	1	0	11	18	https://twitter.com/mrkikaku
29	Heisei Chikaho Tetsudo	Official	3	3	1	1,969	0	2,462	https://twitter.com/chikumaru
30	Kumagawa Tetsudo	Official	3	3	1	545	703	1,962	https://twitter.com/Kumatetu5011

In the relationship between management and the number of tweets, difference of management does not affect the frequency of tweets. Also, some accounts never tweet, just creating an account. (e.g. No.3).

In the relationship between management and contents of tweet, many official accounts are likely to tweet carefully. For example, account No. 23 tweets only the information of operation and event, and it never communicate with other accounts: no reply and no retweet. By contrast, some official accounts having a mascot are likely to tweet actively. For example, No.7 is an account of official rabbit mascot, Mochy, Yamagata Tetsudo. It tweets the information of rabbit, and it sometimes retweets official account's tweet (No.6). Unofficial accounts are also active. For example, No. 16 is managed by local residents. It often tweets introduce of other railway and useful information; for example, it tweets sightseeing spot with a picture. Finally, in the aspect of the number of followers, the accounts of official mascot are tendency to have

a lot of followers.

Follower's attribute

In this subsection, follower's attribute is analyzed on the basis of following four accounts: (1) Ekicho Tama, (2) UsagiekichoMochy, (3) Oraga Minato testudo ouen-dan, and (4) Yurikougen testudo because these accounts have a lot of followers. The accounts of first and second have an official mascot, cat and rabbit, respectively. Third account is managed by local residents. Fourth account is an official account, giving information of local spot. The number of followers in each account are (1) 39,497, (2) 3,050, (3) 3,508, and (4) 2,118, respectively.

The aggregated data of followers' attribute is shown in Table 5. With the regard to gender, the percentage of female is greater than male in the account (1) and (2). On the other hand, percentage of male is greater than female in the account (3) and (4). With the regard to age, the account of (1) (2) and (3) (4) is 30 years old, and 20 years old, respectively. With the regard to residential area, the percentage of Kanto and the area of each railway are greater than other areas. Overall, account (1) is similar characteristic to account (2), and account (3) is similar to account (4).

Table5. Attribute of accounts

Attribute of account		Name of account			
		(1) Ekicho Tama	(2) Usagi ekicho Mochy	(3) Oraga Minato testudo ouen-dan	(4) Yurikougen testudo
Gender	Male	44%	37%	81%	82%
	Female	56%	63%	19%	18%
Age (average): years old		36	41	26	23
District of residence	Hokkaido, Tohoku	7%	28%	6%	34%
	Kanto	41%	45%	65%	40%
	Chubu	11%	7%	10%	9%
	Kinki	31%	12%	11%	11%
	Chugoku, Shikoku	5%	4%	4%	2%
	Kyushu, Okinawa	6%	2%	4%	4%

Co-occurrence networks in above accounts are shown in Figure 7 ~ Figure 10. Account (1) has three big groups: "Railway, hobby and picture", "Game, anime and cartoon", and "Music, movie and read a book". Account (2) has two big groups: "Sightseeing, woman and animal" and "Railway and flower". Both accounts are not dominated by only railway. By contrast, account (3) and (4) have only a big group: "Railway, anime and hobby". In addition, account (3) and (4) have co-occurrence between "Cheer, fan and activity" and "Event, sightseeing and information". It implies that these accounts are followed by those who are interested in cheering and supporting activity of railway.

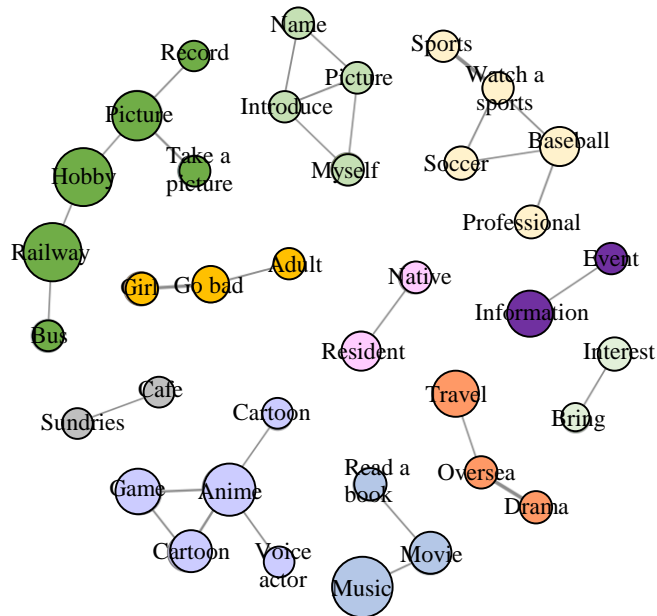


Figure 7. Co-occurrence network- account(1) Ekicho Tama

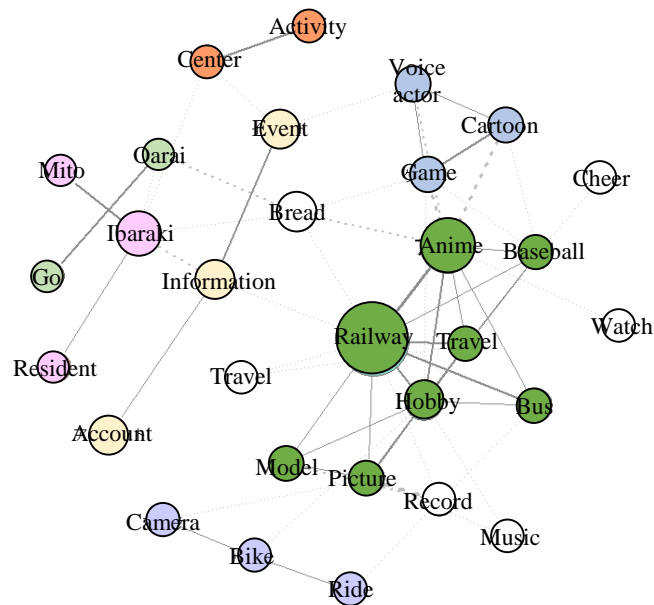


Figure 8. Co-occurrence network- account(2) Usagi ekicho Mochy

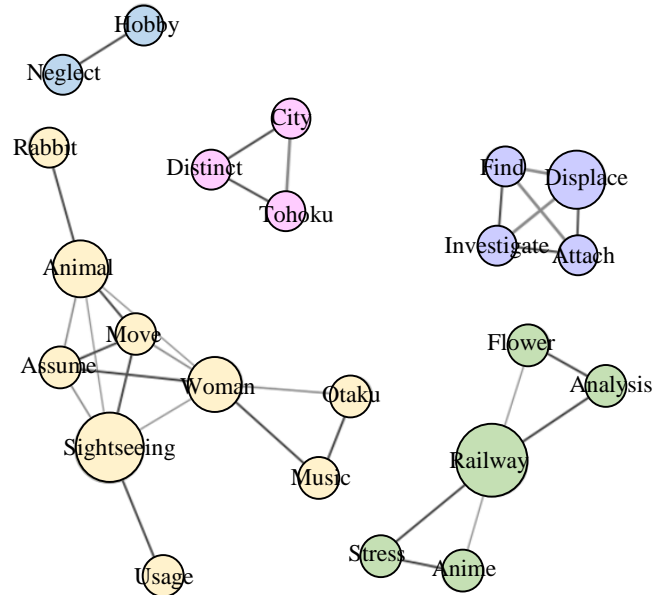


Figure 9. Co-occurrence network- account (3) Oraga Minato testudo ouen-dan

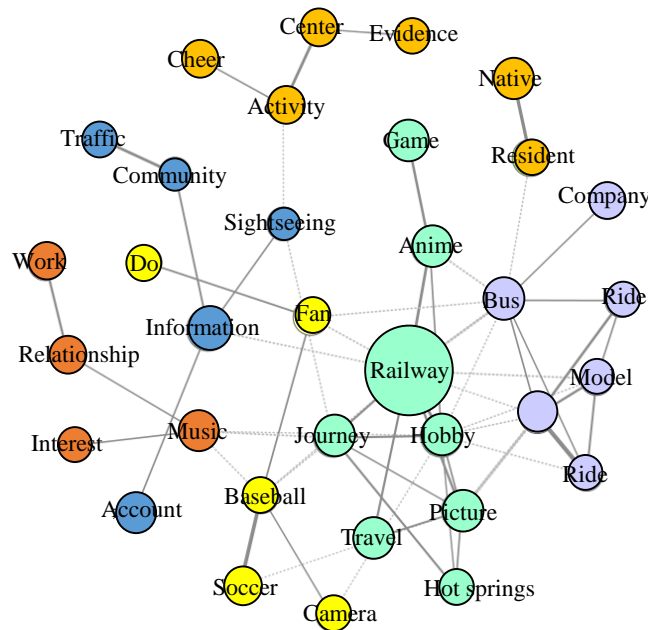


Figure 10. Co-occurrence network- account (4) Yurikougen testudo

CONCLUSION

In this research, the tendency of mass media report related to local railway in chronological order was analyzed, and utilization of social media in the field of local



railway was clarified.

As a result, in the analysis of mass media report, Changes in the number of whole articles related to Tarumi railway was tendency to be similar to the articles of business condition's one. Also, the number of articles related to event and sightseeing resources weremuch less than the article of business condition's one. It implies that readers can associate the article of Tarumi railway with the contents of a crisis of its abolishment. In addition, in the period of that the railway encountered the crisis of abolishment, the contents of promotion of utilization and residents' activity are reported at the same time. In other words, only the period of its crisis, readers cannot know such a topic. Therefore, if local governments have a plan to select such a local railway as an important public transport system and continue to compensate its deficit in the future, in order to let residents understanding, it is important to provide information of the necessary and activity of railway and the via city newsletter to residents constantly.

As a result of utilization of social media in Twitter, many official accounts are likely to hesitate to communicate with other accounts; on the other hand, accounts having an official mascot and unofficial accounts are likely to be active: communicating with other accounts. In addition, followers' attribute is different in the characteristic of accounts. For example, the accounts which support railway are followed by only railway fans' account, mainly. In order to bring in a user who is not interested in a railway;for example, it can be an effective way to create an account having an official mascot, and to communicate with other accounts.

The subject for a future study are as follows. In the analysis of mass media report, this study only analyzed the report of a newspaper company; therefore, in order to generalize the conclusion of this result, it is essential to analyze the report of other newspaper company. In the analysis of utilization of social media, it is important to grasp how to operate a famous account in other fields.

REFERENCES

- [1] Land, Infrastructure and Transportation Ministry, Actual condition in local railway, <http://www.mlit.go.jp/common/001018569.pdf>, 2015. (In Japanese)
- [2] Press Telecommunications committee, seventh public opinion research of mass media, <http://www.chosakai.gr.jp/notification/pdf/report7.pdf>, 2015. (In Japanese)
- [3] Ministry of Internal Affairs and Communications, 2014 WHITE PAPER Information and Communications in Japan, <http://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2014/2014-index.html>, 2014.
- [4] Land, Infrastructure and Transportation Ministry, City Bureau, Investigation of an effective and efficient way to inform, collect and exchange information of community planning wi



- th public-private partnership, http://www.mlit.go.jp/crd/index/case/pdf/120409kanminrenkei_houkokusho.pdf, 2013. (In Japanese)
- [5] Land, Infrastructure and Transportation Ministry, Railway Bureau, Report of local railways toward renovation and activation, -all the participants support a local railway-, <http://www.mlit.go.jp/common/001002354.pdf>, 2013. (In Japanese)
- [6] User Local,Inc website: <http://www.userlocal.jp/> (In Japanese)
- [7] KH Coder website: <http://khc.sourceforge.net/en/>