

Research on the Way of News Dissemination in the Self-Media Era Based on SIS Model

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Abstract

Aiming at the dissemination of news in the era of self-media, firstly, taking the establishment of Xiongan New Area in Hebei as an example to determine the main influencing factors of self-media dissemination, and comprehensively using differential equations, analogy analysis, comparative analysis and other methods; established SIS, SIR, comparative analysis and other models respectively, using MATLAB, EXCEL and other software programming, to get the information dissemination process in the we-media era, the dissemination process of one message encountering another related message, the dissemination process of different types of messages on the same we-media platform and different we-media platforms differences in .

Keywords

Message Propagation, Differential Equation Method, SIS Model, SIR Model, MATLAB.

1. Introduction

We media, also known as "citizen media" or "personal media", refers to private, popular, generalized, and autonomous communicators who use modern and electronic means to reach unspecified majority or specific singles. The general term for new media in which individuals transmit normative and non-normative information. We-media platforms include: blogs, Weibo, WeChat, Baidu official post bars, forums/BBS and other online communities. Hou Liang Ping, a character in the TV series "In the Name of the People", said: "Now is the era of self-media, and any sudden event spreads to the world in a few minutes." Compared with traditional media, we-media based on Internet technology has become a platform for citizens to obtain information, express emotions and thoughts, and participate in social and public life due to its characteristics of instant information dissemination, equality of communication methods, and virtuality of communication identities. It has gradually penetrated into many fields such as politics, economy, culture and society. How information spreads in the self-media era is one of the current focuses of people's attention. If we can accurately grasp the spread process, we can use this spread to guide the healthy development of the media and spread positive energy to benefit the development of human society.

2. Data sources and model assumptions

The data in this paper comes from question B of the 2017 may day League. In order to solve the problem, the following assumptions are put forward: ①when studying media communication, we do not consider the changes in the number of people caused by birth, death, mobility and other factors; ②the number of people a communicator can spread per unit time is directly proportional to the number of people who do not know at that time, and the proportion coefficient is fixed; ③the spread of messages is similar to the infectious disease model. Taking the virus transmission model as an example, in unit time, the number of susceptible people that an infected person can infect is proportional to the total number of susceptible people.

3. Analysis of the Reasonable Propagation Process of a Single Message

3.1. Research ideas

Taking the news of the "establishment of the Xiong'an Special Zone" issued by the Central Committee of the Communist Party of China and the State Council in 2017 as an example, considering that the spread of news is similar to the traditional infectious disease model, it can be used for reference. First of all, through the investigation and statistics of the data in the mobile WeChat platform, to study the reasonable dissemination process of a single message on the self-media platform. Then, combined with the Internet, I learned the process of self-media communication (as shown in Figure 1). After the Central Committee of the Communist Party of China and the State Council announced the "establishment of the Xiong'an Special Zone", on the one hand, there will be communication between the Central Committee of the Communist Party of China, the State Council and the traditional media in the past. On the other hand, the general public is not only the recipient of information, but also the transmitter and publisher of information on the self-media platform. Moreover, the government publishes policy-related information through self-media platforms such as official social networks opened by government agencies, and the general audience can also feed back the information through comments.

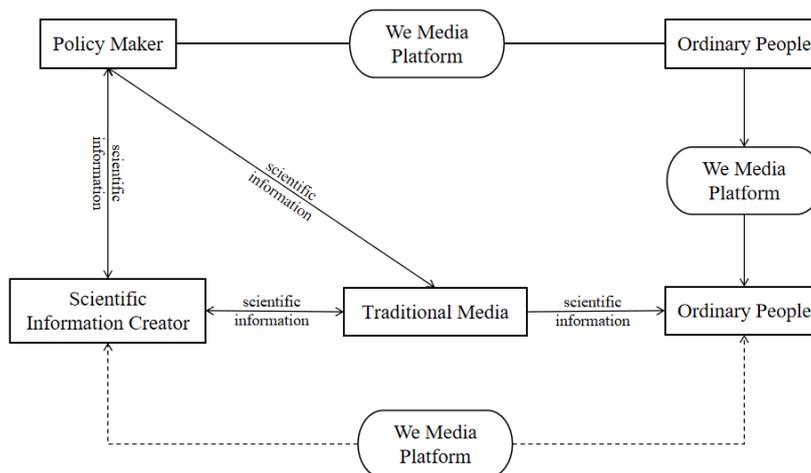


FIGURE 1: We-media platform information dissemination flow chart.

3.2. Research methods

The SIS model is used to indicate that people who have not received the news will become a communicator after knowing the news, and then continue to spread the process, just like the spread of a virus. Assuming that under normal conditions, there is a single piece of information W widely diffused in the population, the diffusion process can be described by a general model:

$$\frac{dX(t)}{dt} = f(X(t)).$$

Among them, $X(t)$ represents the number of individuals with information W in the group at time t , $f(X(t))$ is a function of $X(t)$, which represents the influence of the number of individuals with information in the diffusion process, and the function $f(X(t))$ to describe different diffusion processes. In general, the more individuals with information W in the group, the higher the information diffusion efficiency will be. In the case of self-media participation, the rate of information dissemination will be even faster.

Under normal circumstances, the uninformed ordinary people will be transformed into disseminators of information on the self-media platform, which will change the proportion of disseminators, that is:

$$\begin{cases} \frac{di}{dt} = \lambda i(1 - i) - \mu i, i(0) = i_0, \\ i(t) + s(t) = N. \end{cases}$$

3.3. Result analysis

According to the above conditions, it can be solved:

$$i(t) = \frac{1}{\frac{k}{nk - h} + \left(\frac{1}{i_0} - \frac{k}{nk - h}\right)e^{(h-nk)t}} \quad (h \neq nk).$$

or
$$i(t) = \frac{i_0}{kt + \frac{1}{i_0}} \quad (h = nk).$$

By using MATLAB to plot $i(t)$, the variation trend of the propagation range at different times can be obtained, as shown in Figure 2.

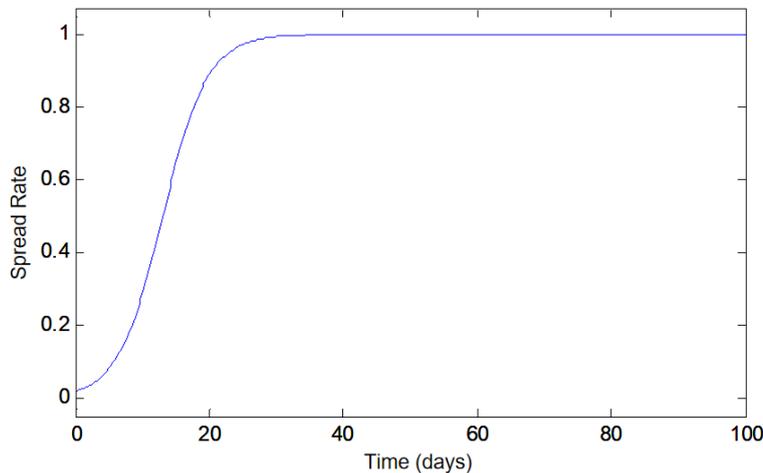


FIGURE 2: Time and rate of propagation.

Here comes the very important concept of threshold, or the threshold phenomenon, that is, a limit of 1 is a threshold, the greater the population, the faster the transmission rate, and the longer the time from the initial stage of news release to being widely known. The formula is as follows:

$$\lim_{t \rightarrow \infty} i(t) = \begin{cases} \frac{nk - h}{k}, \frac{nk}{h} > 1 \\ 0, \frac{nk}{h} \leq 1 \end{cases}$$

The emergence of we media platform provides a new development platform for science communication. The personal platforms of ordinary audiences and official social networking platforms can interact directly. In this case, the proportional coefficient k that makes the number of people a communicator can communicate in unit time proportional to the number of people who are unaware of it at that time changes. The more communication software on we media platform, the faster the communication speed.

4. Impact analysis of highly correlated messages

4.1. Research ideas

Under normal circumstances, the circulation process of news is: social elites government figures mass media opinion leader’s general public. In the process of SIS model researching the dissemination of a single message on the self-media platform, if a new message with a high degree of relevance appears during the dissemination of a single message, through the understanding and analysis of the SIR model, the model is used to analyze its changes. After a news event broke out, it was circulated, forwarded, and commented on the Internet, forming a huge space for public opinion; authoritative media such as TV or news broadcasts came to a conclusion after investigation; netizens on the Internet conducted another survey on the conclusions drawn from the investigation. The popularity of the comments continued to rise, and gradually subsided after the intervention of relevant celebrities.

The information dissemination rules of social network including heat dissemination nodes can be expressed as information to be disseminated, susceptible nodes, heat dissemination nodes, common dissemination nodes, and immune nodes. A schematic diagram of information dissemination in a social network with heat dissemination nodes is shown in Figure 3. (The solid line indicates that there is information dissemination between two points.)

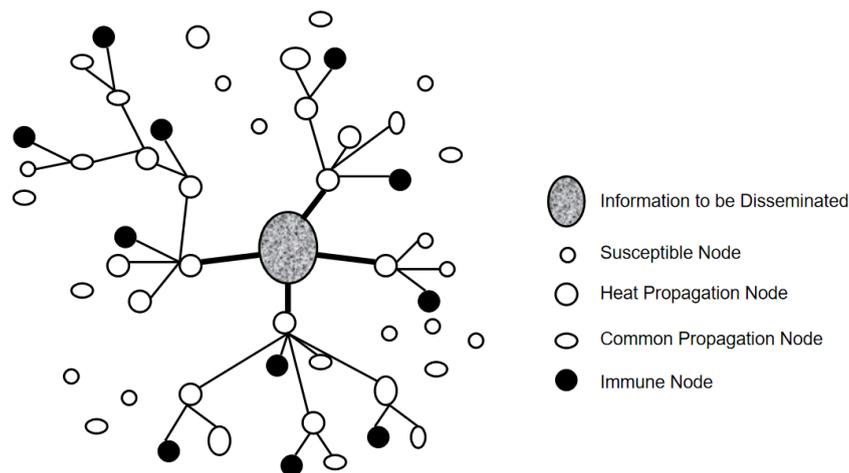


FIGURE 3: Schematic diagram of the process of self-media network information dissemination.

With the reduction of the probability of immunity and the increase in the contact rate between network promoters or common communicators and susceptible communicators, the spread and speed of information in the network will be improved to a certain extent. Propagated to the majority of users in a given network.

4.2. Research methods

The total number of user nodes in the social network is denoted as N , and the social network consists of three types of nodes except the propagation source, the propagation node $i(t)$, the susceptible node $s(t)$ and the removed node $r(t)$.

According to the classic SIR model and the basic characteristics of self-media network information dissemination, the structure diagram of the self-media network information dissemination room model is obtained, as shown in Figure 4.

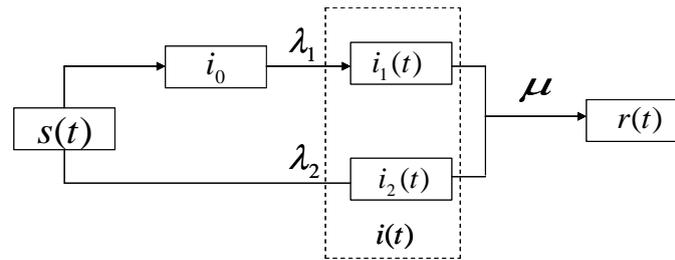


FIGURE 4: Structure diagram of self-media network information room model.

In Figure 4, i_0 shows the proportion of heat propagation nodes in the self-media network, and its value is generally fixed, $i(t)$ represents the proportion of common propagation nodes at time t , which consists of two parts, $i_1(t)$ and $i_2(t)$, where A represents the common propagation node generated by the heat propagation node, and B represents the new common propagation node generated by the common propagation node. λ_1 represents the contact rate of heat spreading nodes; λ_2 represents the contact rate of common spreading nodes; $r(t)$ represents the proportion of removed nodes; μ represents immunity probability; the total number of users in the social network is N .

According to Figure 4, the basic model of SIR can be expressed as a differential equation system as follows:

$$\begin{cases} \frac{ds(t)}{dt} = -\lambda_1 i_0 s(t) - \lambda_2 s(t) i(t) \\ \frac{di(t)}{dt} = \mu [\lambda_1 i_0 s(t) + \lambda_2 s(t) i(t)] \\ \frac{dr(t)}{dt} = (1 - \mu) [\lambda_1 i_0 s(t)] + \lambda_2 s(t) i(t) \\ s(t) + i(t) + i_0 + r(t) = 1 \end{cases}$$

Let $i_0 = i_{10}, i(0) = i_{20}, s(0) = s_0, r(0) = r_0$, Because the solution of $s(t)$ and $i(t)$ is extremely difficult, numerical values are used to pre-estimate the general variation law of $s(t)$ and $i(t)$.

Suppose $\lambda = 1, \mu = 0.3, i(0) = 0.02, s(0) = 0.98$. After running with MATLAB, the change of the proportion of the number of people affected by message propagation over time is obtained, as shown in Figure 5.

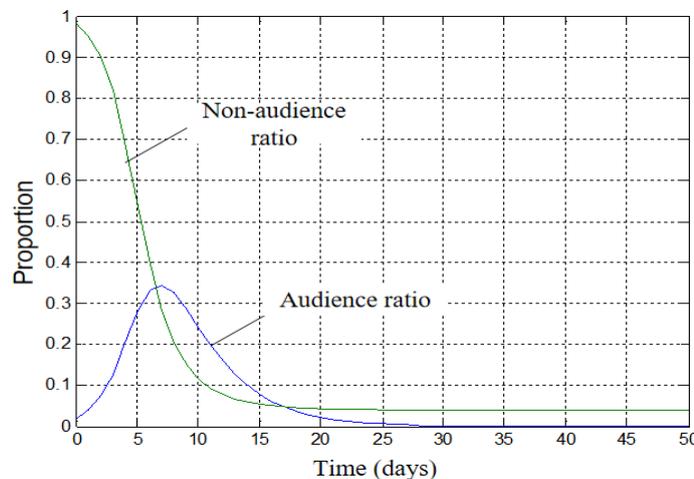


FIGURE 5: Transmission time and number of people affected.

Audience refers to the recipients of information dissemination. As can be seen from Figure 5, with the increase of time, the number of non-audiences gradually decreases. Correspondingly, the number of audiences shows an increasing trend within a certain time range, and then with the passage of time, the number of audiences gradually decreases.

4.3. Result analysis

According to the analysis of the above model, the change of a single message over time will tend to be stable. If there is a new message highly related to it at this time, it will affect the propagation change of the original message and propagate at a higher rate together with the original message. As shown in Figure 6.

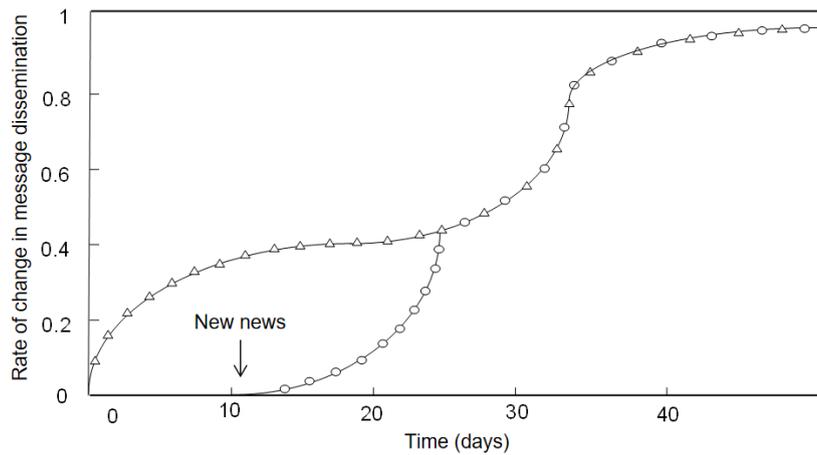


FIGURE 6: Changes in the dissemination of new information after the emergence of new news.

5. Comparative analysis of the communication channels of various news on different platforms

5.1. Research ideas

The comparative method is also called the comparative analysis method or the comparative analysis method. In order to analyze whether there are differences between different types of news in the process of self-media dissemination and whether the same news is disseminated on different self-media platforms, a comparison is made between the marketing strategies of Shandong "vaccine incident" and the movie "Thailand". In this regard, we designed the flow chart shown in Figure 7, which intuitively reflects our solution ideas.

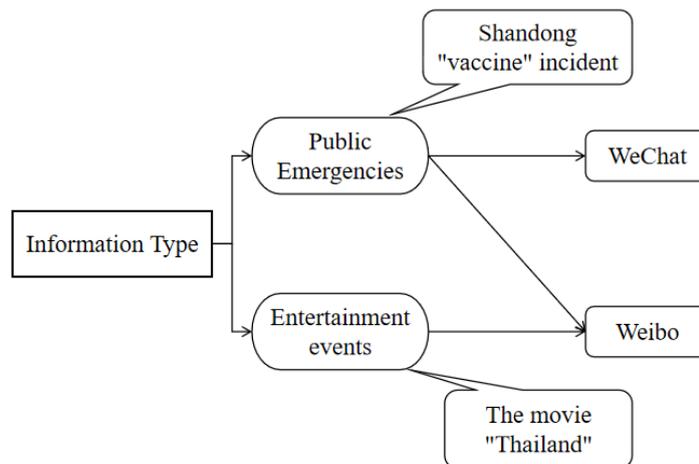


FIGURE 7: The dissemination of various news on different platforms.

The movie "Thai Embarrassment" in Figure 7 is an entertainment event. The audience's attitude towards entertainment events on different we-media platforms is different, and what is reflected is the difference in the dissemination of the same news on different we-media platforms. The Shandong vaccine incident is a sudden public event. It is a different type of news from entertainment events. Therefore, their dissemination process on the same self-media platform is also different.

5.2. Research methods

The film "Thai lost" made full use of the characteristics of microblog marketing, such as low cost, wide coverage, high speed, three-dimensional, interactive, open, convenient and affinity. In addition, the actor Xu Zheng's first director and comedian Wang Baoqiang, the Golden Horse Film Emperor Huang Bo's participation won a certain appeal for the film, which made the film attract the attention of the public and fans. Now, the summary of the number of microblogs related to "Thai embarrassment" sent by the three actors from August 20, 2012 to January 20, 2013 is shown in Figure 8.

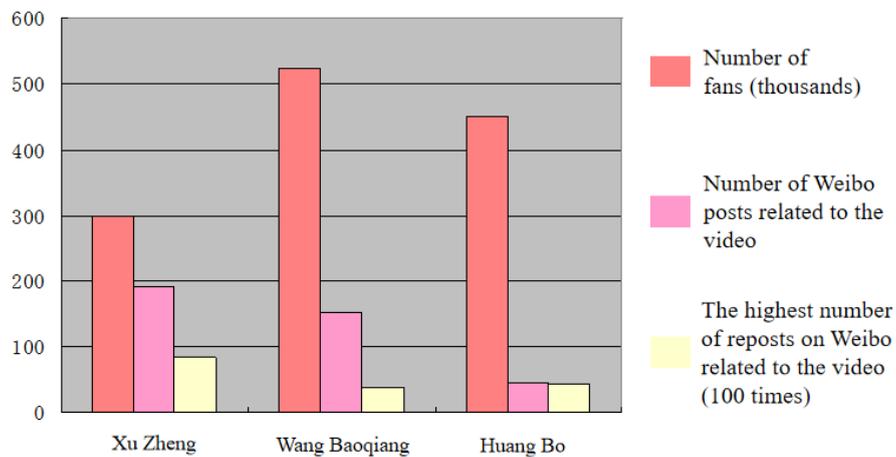


FIGURE 8: Summary column chart of the number of Weibo posts.

Shandong vaccine incident is a public emergency. The illegal vaccine incident on Weibo first came from the "hundreds of millions of yuan of vaccine flowing into 18 provinces without refrigeration: or affecting human lives, Shandong Guangfa check letter" of the surging news on March 18, 2016. On this basis, a large number of marketing accounts, official media and the public were disseminated on Weibo, and public opinion hit like a flood for a time. The negative topics of this event in Weibo hot search are significantly more than positive topics, as shown in Figure 9 (data from Zhiwei data Museum).

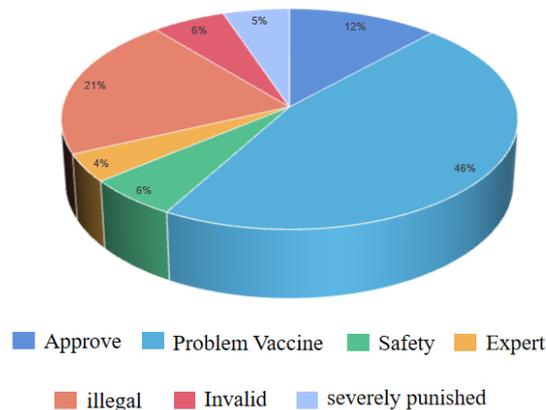


FIGURE 9: Keyword search frequency of Shandong vaccine event.

However, the communication of WeChat is closed, so it is impossible to count the forwarding rate of WeChat public news. The 35 articles with the highest number of readings through WeChat public account are analyzed to analyze the trend of public opinion about the vaccine incident in Shandong, has the largest number of articles, which as shown in Figure 10.

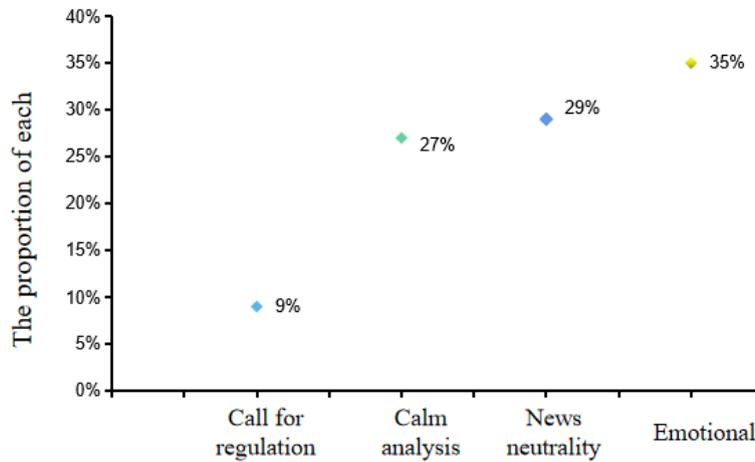


FIGURE 10: Scatter plot of emotional tendencies in the vaccine incident in Shandong.

5.3. Result analysis

Conclusion 1: The main actors of Weibo marketing for the movie "Thai Embarrassment" include the producer, the producer, the director, the screenwriter and the actors. It is proactive to increase the popularity of the film by interacting with fans by posting Weibo; while sudden public events are mostly spontaneous form.

Conclusion 2: After comparative analysis, Weibo has a wide audience and is the most direct source of information on the "problem vaccine" incident. Once the incident occurred, netizens condemned it, and the group was angry for a while. But after a day or two, the topic of "problem vaccines" on Weibo gradually dissipated and was replaced by other topics. The retweets of the incident in the WeChat Moments also hit the face, and the public's views on the "vaccine incident" in Shandong have been retweeted one after another.

It can be seen from this that the communication of Weibo is open, timely and explosive, and the influence of public opinion in the early stage of the incident is easy to reach its peak.

6. Conclusion

With the popularization of Internet technology applications, human beings have entered the era of self-media. In such an era, the ways for people to know and understand the world have been greatly expanded. From newspapers, radio, television, the Internet, to the current self-media based on Internet technology, the channels for information circulation are becoming more and more smooth. Since 2005, the number of Internet users in my country has been increasing, as shown in Figure 11. On the one hand, it is due to the popularity of the Internet, as shown in Table 1, and on the other hand, it is also due to the development of self-media today. We-media based on Internet technology has become an important carrier for citizens to obtain information, express emotions and thoughts, and participate in social public life with its characteristics of instant information dissemination, equality of communication methods, and virtuality of communication identities. And gradually penetrated into the political, economic, cultural, social and many other fields. Therefore, self-media based on Internet technology is bound to be superior to traditional media.

TABLE 1: Number of Internet users and penetration rate.

| Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|--------|-------|
| Number of netizens | 1110 | 1370 | 2100 | 2980 | 3840 | 4573 | 5131 | 56400 | 61758 |
| Internet penetration/% | 8.50 | 10.50 | 16.00 | 22.60 | 28.90 | 34.30 | 38.30 | 42.10 | 45.80 |
| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | -- |
| Number of netizens | 64875 | 68826 | 73125 | 77198 | 82851 | 85400 | 98899 | 103200 | -- |
| Internet penetration /% | 47.90 | 48.80 | 51.70 | 55.80 | 59.60 | 64.50 | 70.40 | 73.00 | -- |

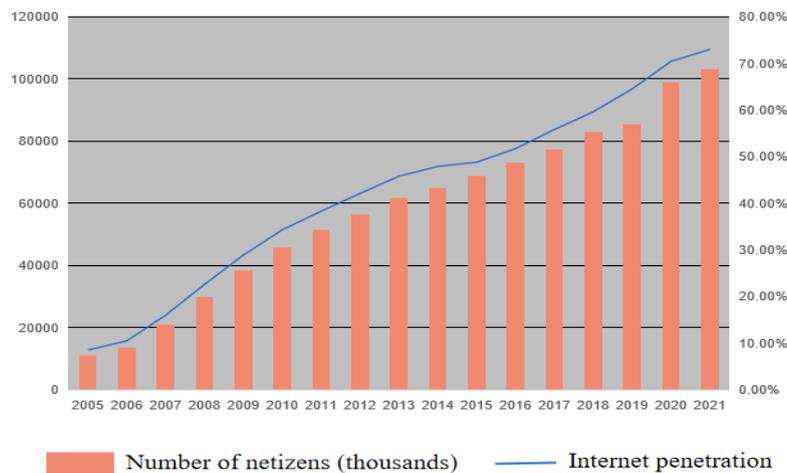


FIGURE 12: Changes in Internet users in China from 2005 to 2021.

References

- [1] S.-M. Huang. "Integration of Three Networks: Constructing a New Business Format of Chinese-style 'Media and Information Industry'", *Modern Communication*, vol.165, no.4, pp.1-4, 2010
- [2] S. -K. Zhang. "Micro content dissemination: conflict analysis of two modes of public opinion generation", *Hebei University*, 2010.
- [3] K. -J. Li, Y. -K Wang. "Application of Improved SIR Model in Social Network Information Dissemination", *Electronic Science and Technology*, vol.26, no.8, pp.168-171, 2013.
- [4] Y. Huang. "Similarities and differences in the topics of Weibo and WeChat in public health emergencies—Taking the 'vaccine incident' in Shandong in 2016 as an example", *Science and Technology Communication*, vol.8, no.16, pp.99-100, 2016.
- [5] K. Chen. "The Weibo Marketing of 'People's Embarrassment in Thailand'", *News World*, no.8, pp.209-210, 2013.
- [6] W. -N. Li. "The New Order of Information Dissemination in the Era of We-Media—Taking Weibo Dissemination Mode as an Example", *Today Media*, no.4, pp.29-30, 2013.
- [7] R.-J. Liu, B. Sun, D.-H. Liu. "Evolutionary game analysis of government governance of network group events", *Journal of Management*, vol.12, no.6, pp.911-919, 2015.
- [8] X.-J. Lin, Y.-M. Zhuang, L.-L. Sun. "Research on SEIR Network Public Opinion Propagation Model with Saturated Contact Rate", *Journal of Intelligence*, vol.34, no.3, pp.150-155, 2015.
- [9] X.-J. Ding. "Research on the dissemination model of microblog public opinion topic based on SCIR", *Computer Engineering and Application*, vol.51, no.8, pp.20-26+78, 2015.

- [10] C. Wang, X.-Y. Yang, K. Xu, et al. "A social network information dissemination model based on SEIR", *Chinese Journal of Electronics*, no.11, pp.2325-2330, 2014.
- [11] L. She, Z.-L. Shen. "Analysis of group behavior based on SIR model under unconventional emergencies", *Journal of Intelligence*, vol.30, no.5, pp.14-17+9, 2011.
- [12] H. Yin. "Review of Network Mass Incident Research", *Frontiers*, vol.301, no.23, pp.196-198, 2011.
- [13] R.-B. Xiao, Y.-F. Zhang. "Evolutionary game analysis of network group event information dissemination", *Complex Systems and Complexity Science*, vol.9, no.1, pp.1-7, 2012.