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Research Article

The Research of Micro-blog Influence Evaluation of Automobile Recall Information

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Abstract

Background: The micro-blog influence of automobile recall information has become an important factor in causing social unrest. This study researches the comprehensive evaluation method of the micro-blog influence, constructs the influence evaluation indicator system, establishes the influence monitoring anticipation mechanism and provides the timely warning for the automobile recall supervisory department to monitor the situation. **Materials and Methods:** Considering the interests and game about automobile recall information spread of three types of micro-blog users who are the manufacturers, consumers and the third party supervision mechanism, using literature review, questionnaire survey, the hierarchy analytic process and so on, the study chose the evaluation indicators and evaluation method of the micro-blog influence of the automobile recall information and sets up the influence index to provide the four grades warning mechanism. **Results:** The method was applied to evaluate the Sina micro-blog influence at some point and found that it can reflect the influence tendency of micro-blog user and the basic state of the current domestic automobile recalls events in micro-blog spread influence: The influence of media users is the largest and the influence of industry, business and personal users is smaller. **Conclusion:** The established indicators and its significance partly support the existing research, at the same time, this study enriches the field of micro-blog research, develops the application space of micro-blog influence and there is certain application value from the assessment results.

Key words: Influence assessment, micro-blog communication, analytic hierarchy process, automobile recall information

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INTRODUCTION

Recently, automobile recall events frequently occur, the recall system and policies had been also frequently introduced, consumer safety awareness and self-protection awareness is gradually strengthened. Baidu data research center pointed out that the annual search index about product safety, automobile recall and industry policy increased significantly. From the perspective of government supervision, there are more than 200 manufacturers to carry out the 853 times recall of defective products and 19790000 vehicles since 2004, while the automotive recall system has just been implemented. There are the recall of defective product 105 times, involving 7587800 vehicles, accounting for 38.34% of the total number of calendar year subjected to AQSIIQ defect investigation. From the perspective of the recall information, AQSIIQ defective product management center has collected 80000 cases of defective information¹ by the end of 2014, about 18000 in 2014.

Obviously, automotive recall information and related policies have become increasingly the problem concerned about by consumers. In order to meet the consumer's right to know the quality problem of automotive products and constantly improve the automobile recall management system, the AQSIIQ defective product management center explores and develops the information network management system, which undertakes the task of the automotive recall information release, the collection of complaints, the education for car owners, etc. after the implementation of the automobile recall system in China in 2004. Also for product quality problems, the center also sets up a complaint telephone, e-mail and communication address and announced these information to the public. Any units and individuals could submit the complaint information on car quality, which is true and detailed through any of the above ways, so as to provide the management support for the car recall event. On the other hand, with the rapid development of social media, micro-blog promotes the innovation of business and management mode with its unique "Fission cycle" transmission mode, at the same time, the consumer public discourse space has been formed. The micro-blog platform has shown important values in some aspects, such as automobile brand building, product safety management control, providing consumers with information and policies on vehicle safety recall, as well as consumer information communication etc. The dissemination of automobile recall information in the micro-blog platform makes a strong focus on the online and offline public opinion and affects the

progress and governance of the government to the automobile recall event in a certain degree and extent. How to evaluate the influence of the automobile recall information in the micro-blog communication needs a set of full evaluation index and method. In this study, we are interested in asking two questions: (1) To establish the evaluation indicator system of the micro-blog influence of automobile recall information and (2) To set up the early warning mechanism of automobile recall event.

The micro-blog influence of automobile recall information relates to two aspects of the automobile recall events and the influence of micro-blog communication. When the automobile recall information released, consumers on car brand and quality would have a lot of attitude changes, as well as the further behavior on the product, which include understanding of other car owners to deal with the attitude of car problem, the enterprise to deal with the situation of car recall event, whether the new users also want to buy products and the speech development tendency on car recall events and so on and then the development tendency of automobile recall event will be affected based on the mechanism of micro-blog information dissemination.

There is a lot of study on product recall issues at home and abroad such as the effect of recall on stock price, the crisis management of recall and public relations, the impact of recall on the manufacturer image, consumer loyalty, consumer willingness to buy, consumer further judgment and behavior, consumer perceived risk and the role of media publicity in the recall event. Du *et al.*² pointed out that, after the recall event occurred, the attitude of enterprises to deal with event, the severity of the incident and the material and psychological adjustment mechanism provided consumers by enterprises will affect the consumer's perceived risk and negative emotions and then affect the consumer's trust and purchase intention². Chen and Chen³ pointed out that the crisis communication is an inevitable measure for the enterprise to deal with the crisis, its effectiveness depends on constraint and limitation of various conditions such as the subject, the content, the mode, the frequency and the opportunity of communication and the personality of the audience³.

Most of the studies on micro-blog communication influence evaluation focus on establishing the evaluation indicator system in which there are some indicators that are often referred to, such as fans number, concerns number, forwarding number, comments number, verification identity, original weibo number etc. and these indicators can characterize the influence in a certain degree, but the emphasis of each is different. Ma *et al.*⁴ studies show that the average

number of weibo forwarded, the weibo mentioned rate and average daily microblogging number are significant factors that can predict the spread of influence. These studies also point out that the express ability of indicators for individual information transmission influence is affected by the type of weibo individual and when the individual is the type of person, fans number and other evaluation indicators are equally important, when the individual is the type of the official media and professional website, forwarding number, comments number, the average forwarding number and comments number showed a strong correlation^{4,5}. Chen *et al.*⁶ constructed a set of micro-blog influence evaluation index system, which consists of the micro-blog using time, original weibo number, public profile of weblogger, forwarding number and so on eight indicators, covering four links of media influence formation which are contact, cognition, persuasion and two time transmission through membership analysis, correlation analysis, discrimination analysis three-step demonstration and selection⁶. Luo⁷ pointed out that the influence could be reflected by the consequences of the impact, especially, the influence scope, size, character, trend and results could be decided through the reflection of things in a study of micro-blog communication influence on major emergencies. Based on this, it is possible that using the degree of communicator well-known to examine influence scope or size, using the degree of issue reputation to examine influence nature that is positive or negative evaluation, using the degree of spread activity to examine influence trend, using the degree of effect reaction to examine influence results, etc.⁷.

MATERIALS AND METHODS

Automobile recall is the activity of the car producer to take measures to eliminate the defects of the products, which have been sold. The defect here is a kind of universal existence case which does not meet the national standards and industry standards of protection of personal and property safety, or unreasonable risk that will endanger the personal and property safety in the same batch, model or category of automotive products because the design, manufacture, marking, etc. The media communication influence is an effect on social, the development and the management when the information is transmitted through the media. On the influence of micro-blog communication of the automobile recall information, the information dissemination may involve the manufacturers, consumer and third party supervision mechanism. These different stakeholders will be issued a statement in a certain manner, or forward, comment on the weibo published by others or agencies, so that the

weibo content was expanded or deepened, the development of the automobile recall event is affected.

Manufacturers include producers and operators, producers are the main responsibility person of the automobile recall incident, are the important factor to control the recall information dissemination opinion trend and operators directly to the consumer, are the important influence on the recall information dissemination. When the car recall, the consumer's attitude to the automobile producer depends on consumer awareness of brand image, the seriousness of the recall, the effect of the manufacturer's crisis management and the extensive and in-depth degree of the automobile recall information dissemination, all these are related to the information communication of the manufacturer's micro-blog platform. On the one hand, manufacturers can use the micro-blog platform to expand the influence, enhance brand competitiveness, improve the micro-blog user's brand awareness, reputation, loyalty and brand association. On the other hand, when the automobile recall information was released, the manufacturer can use the micro-blog platform in time to carry out the crisis communication management, to control the opinion trend of information dissemination so that it is conducive to manufacturers.

Consumers include direct consumers and stakeholders of automotive products, direct consumers are the victims of the car recall and are playing a vital role in the opinion trend of information dissemination and stakeholders are potential consumers or relevant workers and they also have an extremely important influence on the direction of the information dissemination. According to the seriousness of the recall, the attitude and measures taken by the car manufacturers to deal with the incident, consumers will initiative or passively release comments in the micro-blog or directly forward weibo, comment weibo, so that the opinion trend of the car recall events will have been expanded or deepened, the attitude of more consumers on the car brand and the development of car recall events will be affected because of the fission cycle mechanism of micro-blog.

The third party supervision mechanism, including the media and government regulators, these institutions as a recall events supervisor or manager have the obligation and responsibility to control the opinion trend of car recall information dissemination when the car product needs to be recalled because of the accident caused by product defect and they could use the micro-blog platform to publish a variety of policies and principles of study, the real situation of recall events, etc. and make the car recall events could be treated fairly and justly, not only for the sustainable development of the manufacturers, but also to protect the consumers interests

and their personal safety, thereby further improving the perfection of social product safety laws and regulations.

Luo⁷ micro-blog influence evaluation method on major emergencies as the basic framework and using influence index representation of information communication influence, this study evaluated the influence on the automobile recall information communication of three kinds of micro-blog users, such as manufacturer, consumer and the third party supervision mechanism. Because of the different interests of the three kinds of micro blog users, each type of user has a certain attitude toward the influence of micro-blog communication and its influence index represents the tendency of the influence of the automobile recall information.

Manufacturers whose production costs and operating profit are considered as key factors in operating production would intentionally or unintentionally to shrink the responsibility for the accident caused by automobile product defect and would were often inclined to express their own interests on the micro-blog platform, so that it is difficult to form the automobile recall and consumer's consumer rights and interests are damaged because of that auto recall events often means that manufacturers would have more production costs and more operating profit fell.

Consumers would pay attention to the happiness feelings generated by consumption and they would protect their own interests through various channels including in that they will use the micro-blog platform to express their wishes for the car recall, to seek legal support, to seek the support of government regulators and thus facilitate the formation of the car recall, to protect their rights and own interests once personal injury has been caused by car defects.

Manufacturers and consumers are often contradictory and opposed to the auto recall and the micro-blog platform is a kind of fission cycle information dissemination mechanism, which will make the opinion on car recall events may be to inclined the manufacturer or to the consumer. Whether the car recall events should be formed should follow the facts, laws and regulations, follow the principle of fairness and justice, e.g., to help the healthy development of the manufacturers, but also to protect the rights and interests of consumers. Therefore, the third party supervision mechanism should use micro-blog platform to release the relevant information to control the car recall events into a healthy development state.

Although, manufacturers and consumers may have other aspects of the attitude of the car recall, such as manufacturers dvocated promoting recall or consumers are not the main push car recall because of tolerance and understanding of

manufacturers, from the basic starting point of the manufacturers and consumers, both of them are contradictory in most cases, if the influence index of one of them is too larger than the other, then it may lead to the development of the car recall event in an out of control state and it needs to be controlled by the third party supervision mechanism in a timely manner. We can examine three kinds of user's influence index and if the manufacturer's index is far greater than the other two or the consumer's index is far greater than the other two parties, those show that the development of the automobile recall event is in out of control state and if the index of three kind of user is in dangerous areas, which shows that the development of the situation will need to be further investigated and studied. On the whole, the influence index shows the development of the automobile recall information in micro-blog communication, which supports the control, management and decision of the recall events.

Influence assessment needs to set up a set of index system. The concrete methods of influence index setting and calculation are that: Firstly, using the method of literature research to select preliminary influence index system, using delphi method to further filter indicators, secondly, using analytic hierarchy process to construct the two by two comparison matrix, investigating and calculating the relative weight of the elements, calculating the combined weights of each layer element and carrying out the consistency test, third, according to the weight of the index, calculating the comprehensive score that is influence index of all kinds of users which are manufacturers, consumers, third party supervision mechanism combined with user's main indicators.

In this study, a large number of domestic and foreign research literature on the micro-blog influence were read, the influence assessment indicator system of the 18 indicators is preliminarily determined, a questionnaire was designed according to the above index system, university and industry experts more than 40 have accepted the investigation by mail and interviews, etc., 28 copies of questionnaires were returned and sorted out and then the influence evaluation indicator system composed of 3 primary indicators and 82 level indicators were recognized, the two comparison matrix of the 8 indicators were constructed and evaluated according to the importance of indicators by experts and scholars of the last survey by mail. The Yaahp software was used to construct the hierarchical evaluation model and specific data is calculated, so the relative weights of each layer and the combination weight are obtained, the conformance test is also done.

The calculation method of influence index is that: Firstly, the data of all the indicators is normalized in the way that the

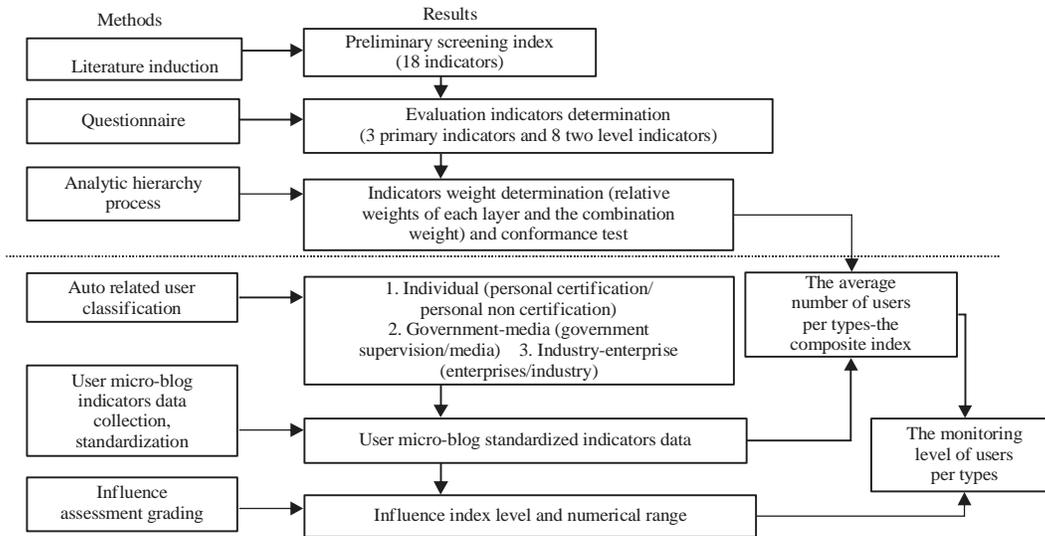


Fig. 1: Influence indicators determination and influence index calculation path graph

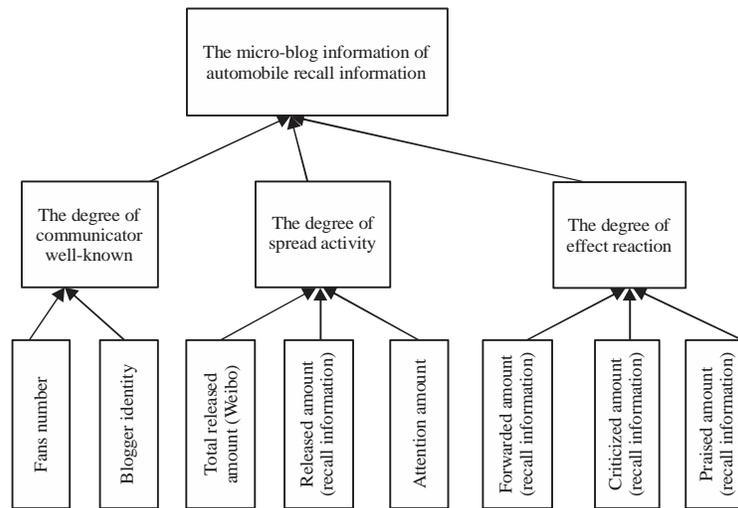


Fig. 2: Hierarchical analysis model of the micro-blog transmission influence of the automobile recall information

largest of the data in each index is viewed as 1 and the other data is calculated in proportion because the unit of each indicator is not unified, secondly, the micro-blog users are divided into three categories such as manufacturers, consumers, third party supervision mechanism, the proportion score of each index of the micro-blog users is multiplied by the weight of the index, calculating the average value of each type of user's composite index, the result of that is named influence comprehensive index, thirdly, the influence index is divided into four grades that are mild grade (0-0.25), alert grade (0.26-0.50), severe grade (0.51-0.75) and danger grade (0.76-1), which were identified as blue, yellow, orange, red color. Thus, the corresponding range of users per types

influence composite index can be determined and the impact monitoring level can also be obtained. Comparing the interval of three types of user impact index can be used to make dynamic early warning and to provide decision support for the decision makers. The methods and results of influence indicators determination and index calculation be shown in the Fig. 1.

RESULTS

Based on the above method, a hierarchical analysis model of the micro-blog transmission influence of the automobile recall information is established. The model is shown in Fig. 2.

Table 1: Meaning of each indicator of micro-blog influence of automobile recall information

First level indicator	Second level indicator	Indicator interpretation
The degree of communicator well-known	Fans number	The number of fans, the greater the scope of the impact
	Blogger identity	Agency's authority, whether direct manufacturers, whether consumers are certified using the identity weight to measure blogger, getting those through the expert evaluation
The degree of spread activity	Total released amount (weibo)	The greater the amount of weibo is released, the greater active
	Released amount (recall information)	The greater the amount of weibo is released related to recall information, the greater active
	Attention amount	The greater the amount of attention users, the more and more quickly information access the greater active
The degree of effect reaction	Forwarded amount (recall information)	The greater the amount of recall information is forwarded, the greater the impact
	Criticized amount (recall information)	The greater the amount of recall information is criticized, the greater the impact
	Praised amount (recall information)	The greater the amount of recall information is praised the greater the impact

Table 2: Weight of the evaluation indicators and ranking of micro-blog influence of automobile recall information

First level indicator	Consistency ratio and λ_{max} of first level		Second level indicator	Consistency ratio and λ_{max} of second level		Sorting	Total sorting weight
	Weight of the first level	Weight of the second level		Weight of the second level	Weight of the second level		
Degree of communicator well-known	0.0057, 3.0059	0.2599	Fans number	0.0000, 2.0000	0.5	3	0.13
			Blogger identity		0.5	4	0.13
Degree of spread activity	0.3275	0.4126	Total released amount (weibo)	0.0000, 3.0000	0.2764	6	0.0905
			Released amount (recall information)		0.5954	2	0.195
			Attention amount		0.1283	7	0.042
Degree of effect reaction	0.4126	0.4126	Forwarded amount (recall information)	0.0311, 3.0324	0.7085	1	0.2923
			Criticized amount (recall information)		0.2311	5	0.0954
			Praised amount (recall information)		0.0603	8	0.0249

Table 3: Influence index level and numerical range

Influence assessment level	Mild grade	Alert grade	Severe grade	Danger grade
Influence index range	0-0.25	0.26-0.50	0.51-0.75	0.76-1
Influence recognition color	blue	yellow	orange	red

The meaning of each indicator of the micro-blog influence of the automobile recall information is shown in Table 1.

The survey data were input into the Yaahp software, the weight of the indicators were obtained and the consistency test of the judgment matrix also were passed. The results are shown in Table 2. The influence index level and numerical range be shown in Table 3.

The micro-blog influence of automobile recall information could be investigated from two aspects of the long-term and short-term. Some micro-blog would have a more profound impact on society production and management reform, social benefits, constantly to be forwarded and comment. Observation of such a long range of micro-blog helps to improve the follow-up of the work. While others micro-blog related to sudden public crisis, related to the social stability or unrest. Observation of, such a short term of micro-blog is helpful to timely control of the situation. This study collects the Sina micro-blog on the automobile recall information before June 11, 2015, makes an empirical study on the model of the above construction.

First of all, to search with "Car recall" as the key words so as to get a total of 148 weibo which associated with 85 users who was screened out when the "Selection" was set up. Secondly, to crawl those user's data including attention amount, fans number, total released amount, recall information released amount, forwarded amount, criticized amount, praised amount, total of 7 index data. Thirdly, all micro-blog users will be classified. Considering the user's registration name and the interests of all types of users, it is possible to use the micro-blog users of the industry and enterprises on behalf of manufacturers, with individual users on behalf of consumers, with regulatory authorities and media micro-blog users on behalf of the third party supervision mechanism, that are three big categories and six small class. Because of the small class in the big categories of users whose interests also exist a certain gap, the big category can be divided into a small class which helps to analyze the influence of various types of users. To this end, all the micro-blogging will be divided into individual (certified and non certified), government-media (government supervision and media) and industry-enterprise (industry and enterprise) six small class of three big categories. Fourth of all, to calculate the comprehensive influence index of various types of users according to the above evaluation method.

Finishing the collection of micro-blog data, important information be summarized as shown in Table 4 and 5.

Table 4: Blogger type and quantity of releasing the car recall information

Blogger categories	No. of bloggers	Blogger small class	No. of bloggers
Individual	20	Personal certification	11
		Personal non certification	9
Government-media	46	Government supervision	16
		Media	31
		Enterprises	7
Industry-enterprise	18	Enterprises	7
		Industry	11
Total	85		85

Table 5: Blogger information that important indicators ranked by the front

Blogger who released most of the recall information micro-blog	Micro-blog quantity	Blogger and micro-blog of the most of forwarded recall information	Micro-blog quantity	Blogger of the most of micro-blog	Micro-blog quantity	Blogger of the most of fans	Fans quantity (million)
Sina finance	16	Sogou search release: The car recall big data report.....	1436	Sina finance	112090	China news weekly	38.23
Sina auto	16	Bao Tao Aar Supplies: BMW will recall 230 thousand cars.....	373	Global market report	106472	Daily economic news	27.82
Shanghai quality supervision release	14	CCTV Finance: Part of Bora 1.4T recall...	214	Daily economic news	105865	Economic observer	22.65
Automobile marketing analysis	9	Wang Xukun: I firmly believe that the success of human rights...	160	Wall street journal Chinese web	100651	CCTV finance	22.40
Wall street journal Chinese web	5	BITAUTO: If 2014 recalls a gala...	101	Yangtse evening post	90859	Xinhua viewpoint	21.11

Table 6: Comprehensive influence index of various types of users

Blogger categories	Influence index	Blogger small class	Influence index
Individual	0.1996	Personal certification	0.2353
		Personal non certification	0.1315
Government-media	0.2566	Government supervision	0.2086
		Media	0.2531
Industry-enterprise	0.172	Enterprises	0.1544
		Industry	0.1893

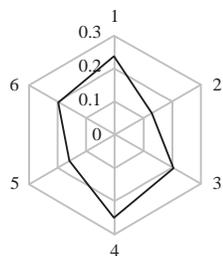


Fig. 3: Radar chart of the influence index

Because of the “Blogger identity” of, which data in the micro-blog users are not reflected, considering the status of these types of users in the social influence, a considerable number of experts are required to give a certain weight to “Blogger identity” of the various types of users. In the end, the weight of “Blogger identity” of all kinds of users are personal certification as 1, personal non certification as 0.8, government supervision as 1, media as 0.8, industry as 1, enterprises as 0.8. The results be shown in the Table 6. The radar chart is

drawn according to the results of the calculation, which it can visually display the influence tendency of all kinds of users and which be shown in the Fig. 3.

DISCUSSION

From the perspective of the big categories, the influence index of government-media users was more than 0.25, which belongs to the warning level and the influence index of other two types of user were between 0-0.25, which belongs to the mild degree, in some degree, it also shows the dynamic tendency of the micro-blog influence of the automobile recall information until then. This shows that the influence of individual and industry-enterprise who were contradictory is relatively low and the influence of government-media is bigger and basically can control the direction of micro-blog so that the micro-blog platform will not affect the turbulence of social thoughts. The reality is also true, that is, there is no social unrest caused by the micro-blog spread of automobile recall information before and after of the time where data is collected.

From the view of the small class user, the influence of media users is the biggest, which belongs to the warning level, followed by personal certification influence and enterprise sort fifth, followed by personal non certification that is the smallest. There is a certain gap in the ranking of the influence assessment by the big categories and by the small class,

the main reason is that the evaluation is based on the calculation results of the index combined weight, especially, each indicator has different effects on different types of users. The top three indicators of comprehensive ranking, as forwarded amount, released amount and fans number, are the most important indicators of all types of users of micro-blog's influence, which coincides with the study conclusion of the Ma *et al.*⁴

From a single indicator, the number of micro-blog about the automobile recall released by automobile safety as an official micro-blog website is the most, up to 285, ranking first and the amount of weibo forwarded is 583 times, ranking ninth. The number of weibo released by Sina car is 61, ranking ninth, in which the number of forwarded weibo is 5463 times, is the largest, ranking first. Female lawyer Cui Jianan, personal authentication user, is also a greater influence user, her two indicators were ranked 10 and 11.

This study indicates that, one, the micro-blog influence of car recall information of enterprise is relatively small, which shows that the automobile enterprises have not paid attention to the micro-blog influence on the automobile recall events and the enterprises competitiveness. Two, the influence of personal certification user is ranked in second, which shows that consumers have been quite concerned about the car recall events and have a certain sense to maintain the personal consumption rights. Three, the influence index of the industry-enterprise and the individual is mild level and the influence index of the government-media is highest, which shows that the information dissemination influence on the evaluation day is relatively balanced, which will not produce the fluctuation of larger social thoughts.

Auto recall is related to consumer rights and interests, the sustainable development of the automobile enterprises and the social crisis management problems caused by the automobile recall, which involves the perfection of the supervision mechanism and laws and regulations, the technical analysis and the practical ability of the technical institutions. With the development of internet technology, regulatory agencies have the responsibility and obligation to take control of the incident development, the driving force and result of the event at any time and they should be timely response to promote the events development towards social harmony and progress.

The majority of micro-blog influence assessment indicators system determined by this article similar to the existing such as, Luo⁷, He *et al.*⁸ and Liang *et al.*⁹. The difference is that, the study focuses on the dissemination of automobile recall information, distinguishes different types of micro-blog users, considers the interests of users and their

game and believes the development of the car recall events is determined by the game results, thus the warning mechanism of automobile recall events is formed. There is a new breakthrough in study perspective and content, the research field of micro-blog influence is enriched and application prospects is opened up.

The assessment method can also be applied to the daily information monitoring and risk management activities. For the sudden car events related to security, regulators can analyze the influence of the micro-blog information dissemination at any time, to monitor developments. When a certain kind of user influence index reached a serious level or dangerous level and seriously deviated from the influence of other types of users. The regulator should be timely warning for the relevant agencies of car recall events to make them track the development trend, make decision plan and deal with the crisis.

At present, the state defective product management center has established the automobile recall information management platform and also has improved the connection of the platform and social network and the reality and the burst of the auto safety accident can be randomly monitored at any time. This study also provides an important reference value for the improvement of the platform.

The above empirical adopted a longer period of micro-blog data, reflecting the long-term impact of the car recall information micro-blog. Clearly, these indicators such as the forwarded amount of the recall information, the criticized amount of the recall information and the praised amount of recall information should have a larger weight. For the recent micro-blog that may cause social unrest, the blogger identity, fans number and total weibo released amount would have larger weights, thus the micro-blog of different types of bloggers will produced different influence index. Long term and short term automobile recall information micro-blog influence and its index has different guiding opinions on management practice. The model established in this study is not different from this point, which is to be further studied in the future.

CONCLUSION

We have established the micro-blogs influence evaluation indicator system of automobile recall information and the early warning mechanism of the automobile recall. Based on this method, an empirical analysis is made on the data of Sina micro-blog in the specific period. This study found the basic state of the current domestic automobile recalls events in micro-blog spread influence: The influence of media users

is the largest and the influence of industry, business and personal users is smaller. In a certain extent, this situation reflects the attention degree of various groups on the automobile recall, so that this can be used as the basis for the government to control the development of the situation. The fission spread mechanism of micro-blog led to micro-blog user influence depends on two aspects, one is the individual efforts of bloggers, on the other hand is a blogger group effort. The main reason is the influence evaluation indicators itself has partial subjectivity and objectivity, so that the size of the micro-blog spread influence of a specific car recall incident will present a resonance situation. In addition, it is necessary to carry out study on the influence of more extensive media information dissemination, to establish a unified impact assessment indicators and effectively improve the early warning mechanisms of influence.

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