

# Research on the Enterprise Response to Network Public Opinions Crisis

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**Abstract.** The study analyzes the whole process of "Mouse Scandal" incident in a catering company called Haidilao which is famous for its excellent service and the situation of rapid overturn of public opinion to help enterprises find the most appropriate way to deal with public relation crises. Thereby understanding what kind of effective measures enterprises should take when faced with unexpected crisis events can promote the public opinion trend based on System Dynamics. It is a new perspective to use the method of system dynamics combined with textual emotion analysis and Vensim tool to understand the law of positive and negative public opinions of crisis events in enterprises. The method can analyze the interaction between the main roles in the system and the force of related factors, explore the evolution mechanism of the various interdependent subsystems, and find out the laws that affect the proliferation of public opinion. Through the simulation study on the incident of "Mouse Scandal" in Haidilao, it is proved that the most important factor influencing the public opinion trend is the enterprise response threshold, high-level enterprise responsibility attitude and the impact on core competitiveness among the many crisis-affecting factors. They should be enterprises' most concerned business in response to crisis events.

**Keywords:** Enterprise crisis response; positive and negative network public opinion; sensibility factors sorting; emotion tendency.

## 1. Introduction

The number of enterprise crisis incidents has increased significantly over recent years, and has presented an increasing trend. However, the government's ability to respond to grievances has risen, while the fragility of companies in this area has been exposed, often making enterprise crisis events the biggest Network public opinion of the year [1]. The enterprise crisis event spread rapidly in the network and its negative information tends to gather the attention of netizens, which forming network public opinion with a wide range of influence. The development of negative public opinion will affect the social reputation and credit of the enterprise, thus affecting the short-term interests and even the survival of it. Our paper concludes that if companies can pay attention to the content of netizens in the positive public opinions hidden in negative public opinions, and actively guiding them, then the positive public opinion will rise faster and eventually gain the upper hand, minimizing the impact of crisis events on enterprise brand image and operating profits.

Qi Jiayin made recommendations for government public crisis management decisions using system dynamics methods [2]; Du Rong et.al helped the government control the development of crisis events, compared two dynamic models of network opinion developed in a multi-agent complex system, which have the difference in the involvement of government agent [3]. Some scholars have analyzed the network public opinion of enterprises, but the number is relatively small. For example, Qu Qixing believed that they could design formulas of the network public opinion heat for enterprise microblogs to help enterprises predict network public opinion heat [4]. Shuyuan Deng et al. proposed a method for classifying domain-specific sentiment categorizations of existing sentiment lexicons using unannotated corpora and dictionaries, which improved the performance of emotional classification significantly [5].

These scholars have studied theoretically how companies deal with public opinion mostly with few empirical studies. The articles analyzing the overall enthusiasm of the public opinion does not classify the sensation according to the emotional tendency, and the effect of positive lyricism is often neglected, which is difficult to amplify its influence. At the same time, there is a lack of analysis of positive and exemplary effect cases. This paper develops a systematic and comprehensive approach

to help companies' decision-makers fully understand the relationship between the various factors affecting crisis events, predict the effectiveness of decisions, and eliminate the impact of public opinion on crisis events with minimal cost. The method is simulating the case of Haidilao's proper handling of the "mouse scandal" crisis event based on the online sentiment analysis tools and system dynamics model.

## **2. Model Development**

### **2.1 System Boundary Determination and Basic Assumptions**

The research object of the system is set to netizens, online media, enterprises, governments and crisis events themselves. It is assumed that these five subjects are the main factors affecting the changes in the network public opinion, regardless of other subject influences. This study will focus on the negative and positive network public opinion of enterprises.

The following assumptions can facilitate our research: First, it is assumed that crisis events are mainly spread on the Internet; the events are independent of each other and there is no coupling effect; the analysis of emotional tendencies of public opinion focuses on textual data on the web, facilitating text mining.

### **2.2 Analysis of the Main Body of Systems**

Enterprise crisis events usually go through the process of being exposed by the media, known to the netizens, and heated up. Then the subsystems interact with each other to form positive and negative public opinions, eventually the heat declining. Determining the main body of the system and its action path can contribute to establishing an effective system dynamics model. In the network public opinion system of enterprise crisis events, five main bodies with major relationships are set up: netizens, enterprises, online media, government, and crisis events.

Netizens discuss enterprise crisis events mainly for the purpose of communication and the purpose of participation that netizens to express their views and exercise their rights as members of society. Different perceptions of network public opinion of enterprises result in their different levels of attention, affecting public satisfaction with companies and their measures. These measures include improving the response speed, increasing the accountability of enterprise executive, and increasing the publicity degree of information about events. The online media refers to tools for social communication, such as web forums, instant messaging tools, blogs, microblogs, and social networking sites [6]. It makes communication fast, open and interactive, and is responsible for social responsibility such as guiding and supervising public opinions. In the internet public sentiment triggered by enterprise crisis events, the government is mainly responsible for guiding and standardizing various types of enterprises before the occurrence of events, criticizing and rectifying enterprise harm behaviors after the occurrence, and supervising their future enterprise activities. The government's participation represents the government's attention, so netizens tend to pay close attention to government participation [7]. Enterprise crisis events are the fuse of network public opinion. After the outbreak of crisis events, it will cause concern and heated discussion among netizens. The degree of harm of the event and the influence of the event become the main components of the event's force [8].

### **2.3 Subsystems Analysis**

There are 43 variables in the flow graph of the system, including 4 stocks, 9 flows, 16 auxiliary variables, and 14 constants. These variables form five subsystems, namely the enterprise subsystem, the netizen subsystem, the network news media subsystem, the government subsystem and the crisis event subsystem. These subsystems are mainly related to each other through the positive and negative network public sentiment of enterprise crisis events.

Corporate attention, corporate response perception, corporate strength and its components have affected the satisfaction of netizens to enterprises. The greater the satisfaction of netizens with enterprises, the less attention will be paid to the events; otherwise, they will continue to pay attention

to the progress of the events. Then the sensational heat will decrease as the netizens' satisfaction with the government increases, forming a negative reinforcement loop.

The influence of events, online news media, government participation, opinion leaders and the curiosity of netizens determine the attention of netizens. The greater the attention of netizens to the event, the more attention will be paid to the appointment, and the number of comments will increase. This in turn leads to increased participation of netizens, which affects the heat of public opinion. The heat of public opinion will further stimulate the attention of netizens, and finally form a positive reinforcement loop.

For the online media subsystem, the expansion of the influence of corporate crisis events will cause online media to release more news. The number of news also represents the attention of the online media, and the degree of attention will cause the media to publish and repost more news, thereby increasing the heat of public opinion.

For the government system, the public's negative network public sentiment has triggered the government's attention. This, together with the government's satisfaction with the company's handling of public opinion, determines whether it is necessary to publish the corresponding news, the number of which represents the government's participation in the event. The degree of government participation has affected the attention of netizens and the participation of online media, which indirectly affects the negative public sentiment of enterprises.

Since the influence and harm of the incident affect the impact of the event, their changes are directly proportional to the changes of events force and the degree of government attention. However, the time factor will gradually reduce the force of the event, so the time variable should be considered.

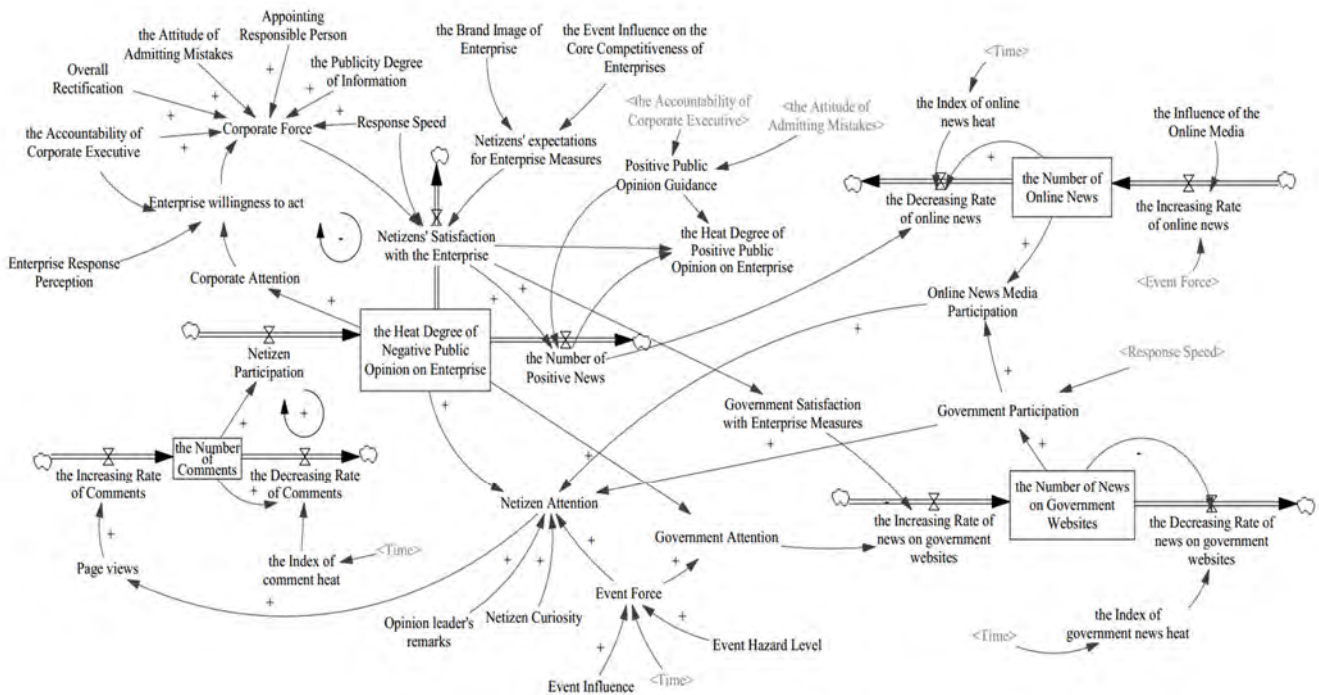


Fig. 1 Flow diagram of network public opinion mechanism

## 2.4 Systems Archetype Analysis

Qualitative conclusions of fundamental model analysis can effectively guide quantitative analysis. The enterprise subsystem and the netizen subsystem in this model together constitute the “limits to growth” of positive and negative network public opinion. It means that the heat of public opinion will not increase endlessly. The system dynamics modeling method is to find the variables that have influence on the system, and then find the causal relationship between the variables, and construct a formula that can calculate the values of the variables, thus realizing the system simulation. Some of

the calculation formulas for the main variables, the scores are obtained by the expert scoring method are as follows.

$$\text{Event Force} = (0.415 * \text{Event Influence} + 0.585 * \text{Event Hazard Level} * \text{EXP}(-\text{Time}/8)) \quad (1)$$

The event force will show an exponential decrease with time. The study used the expert scoring method to determine the weight of the event impact and the hazard level of the event. The scoring range was set to [0, 10], the event hazard level was 8.523, and the event impact was 9.205.

$$\text{The Heat Degree of Negative Public Opinion on Enterprise} = \text{INTEG} (\text{Netizen participation} - \text{the number of positive news} - \text{Netizens' satisfaction with the enterprise}, 0) \quad (2)$$

$$\text{The Heat Degree of Positive Public Opinion on Enterprise} = (\text{Positive public opinion guidance} * \text{the number of positive news} + \text{Netizens' satisfaction with the enterprise} * 5) * 6.9 \quad (3)$$

Positive public opinion guidance will promote the increase of positive news, and the satisfaction of netizens with enterprises will increase the positive public opinion. After interviews and expert scoring, it was found that the company's attitude of admitting mistakes and the accountability of corporate executive determined the guiding force of positive public opinion.

$$\text{Netizen attention} = \text{Netizen curiosity} * \text{event force} + (0.4 * \text{Online news media participation} + 0.25 * \text{The Heat Degree of Negative Public Opinion on Enterprise} + 0.1 * \text{Government participation} + 0.25 * \text{Opinion leader's remarks}) \quad (4)$$

Four variables have a direct impact on the attention of netizens. The “network news media attention” has the greatest impact, so it has the highest proportion.

$$\text{Netizens' satisfaction with the enterprise} = \text{DELAY N} (\text{Corporate force} - \text{Netizens' expectations for business} + \text{Response speed}, 4.5, 0, 1) \quad (5)$$

Different brand image of enterprises will affect the expectations of netizens on enterprises. The higher the expected, the easier it is to reduce the satisfaction of enterprises. The quick response means that enterprises are highly concerned about crisis events, so companies will improve their own speed of problem solving, which increases the satisfaction of netizens to enterprises.

$$\text{Enterprise willingness to act} = \text{IF THEN ELSE} (\text{Corporate attention} \geq \text{Enterprise response perception}, (\text{Corporate attention} + \text{the accountability of corporate executive}) / \text{Enterprise response perception}, 0) \quad (6)$$

By using the logic judgment function to compare the enterprise attention with the enterprise response perception, if the enterprise attention does not reach the value of enterprise response perception, the enterprise will adopt the inaction method.

$$\text{Corporate force} = \text{Enterprise willingness to act} * (0.479 * \text{the Publicity Degree of information} + 0.594 * \text{Response speed} + 0.419 * \text{Overall rectification} + 0.627 * \text{the attitude of admitting mistakes} + 0.446 * \text{Appointing responsible Person} + 0.529 * \text{the accountability of corporate executive}) \quad (7)$$

$$\text{Government participation} = 100 - 32.05 * \text{EXP} (-0.0007634 * \text{the number of news on government websites}) - \text{Response Speed} \quad (8)$$

$$\text{Government attention} = 100 - 36.1 * \text{EXP} (-0.001142 * (\text{Event force} + \text{The Heat Degree of Negative Public Opinion on Enterprise})) \quad (9)$$

### 3. Empirical Analysis and Model Simulating

#### 3.1 Empirical Analysis

On August 25, 2017, after four months of in-depth investigation, Legal Mirror revealed that the kitchens were exposed to health hazards such as rats in two branches of Haidilao, one of the most famous hot pot chain restaurants in china. The problem has caused widespread public concern and discussion. The fastest reversal of the public opinion came after the rapid response of Haidilao to the crisis event, and its crisis public relations once again stimulated extensive discussion of public opinion.

The main reasons why we use this case are as follows. The event is complete, which is significant for studying the interaction mechanism of enterprise crisis events. The Haidilao Mouse Scandal took place on August 25, 2017. Until now, it has completely experienced the whole process of a crisis event. The role of enterprises, online media, netizens, and governments is clear. Within three hours after the “Mouse Scandal”, the company released the results of the investigation, apologized and immediately announced the specific measures for rectification to effectively reverse the public opinion direction. On the other hand, many online media have intervened in the public opinion center with in-depth analysis of corporate public relations, and constantly strengthened the image of the company's response. Netizens have actively commented on official responses, making online public opinion tend to be positive. The response is also very good and the reference is obvious, which has made obvious reference effect.

The research takes the microblog “Events at Haidilao Hot Pot Beijing Jinsong Branch and Sun Palace Branch Processing Bulletin” as an example. It was released by the official media account of “Haidilao Hot Pot” at Sina Weibo platform on August 25th, 2017. We used the web crawler Gooseeker to capture the key data of this Weibo, including the number of comments, the number of likes and the comment text. The Weibo has 18,122 reposts, 18,103 likes and 12,492 comments, covering 170 million people, causing high attention and having a large influence.

#### 3.2 Simulation Result Analysis

According to the amount of data, this study weighted the positive and negative network public opinion analysis obtained by the Qingbo website to get the final positive and negative public opinion score. The score ranges from 0-1. The closer to 0, the lower the heat of public opinion. The closer to 1, the higher the heat of public opinion. The simulated values represent the results of the system dynamics simulation, and the real values denote the weighted results above. We simulate the 72-hour reality to verify the reliability of the model. As shown in Figures 2, V1 and V3 are the simulated values of positive and negative public opinions, respectively, and V2 and V4 are the true values of positive and negative public opinions, respectively. Good fitting results indicates that the model is suitable for simulation prediction.

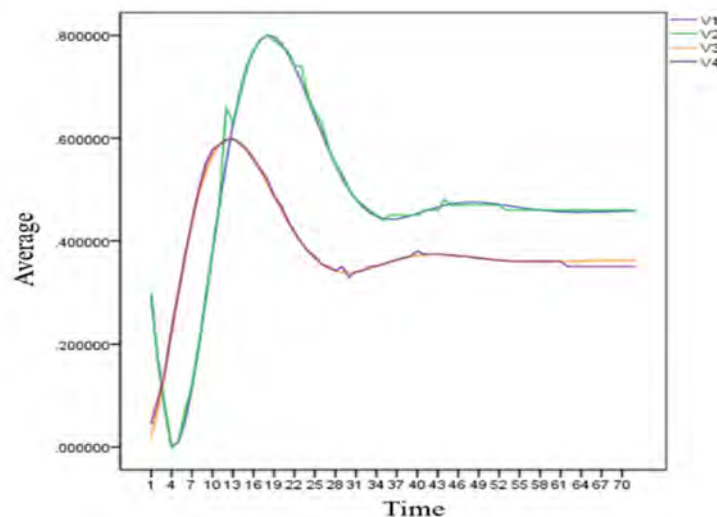


Fig.2 Fitting of simulated and real values of Positive and negative public opinions



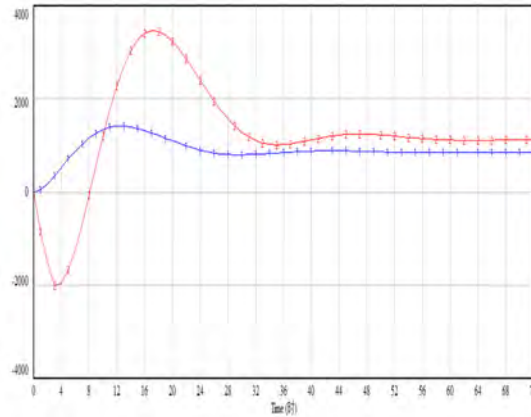


Fig. 3 Simulation results of positive and negative public opinion in the initial situation

According to the actual situation of the event, the initial time of the simulation is set to zero, the step size is one, and the unit is hour. The simulation runs for 72 hours to simulate the actual situation of the heat of negative enterprise public opinion and positive enterprise public opinion from August 25 to 27th. A simulation diagram of the negative heat and positive heat of public opinion is shown in Figure 3. The line with a lower peak represent the the negative heat of public opinion.

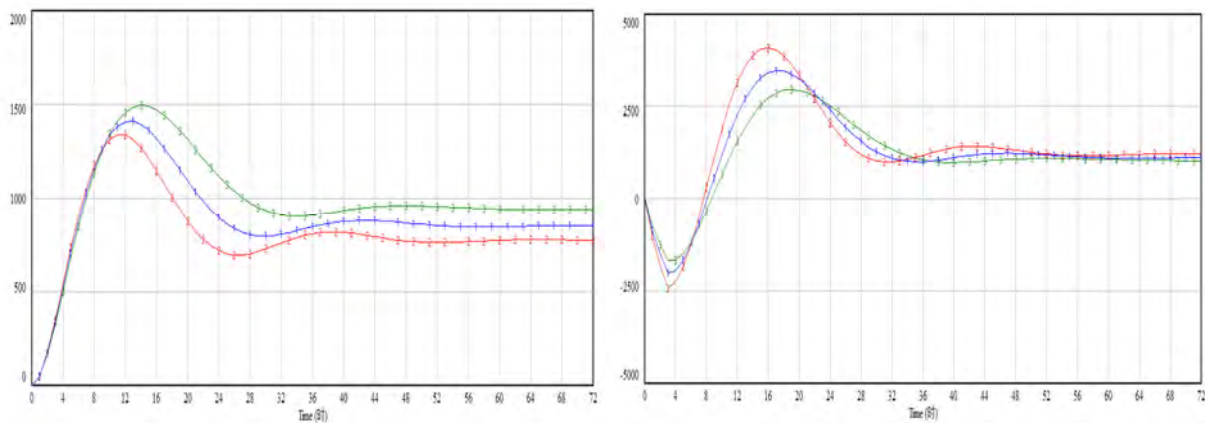


Fig. 4 The changes of negative public opinion after changing the accountability of enterprise executive

Fig. 5 The changes of positive public opinion after changing the accountability of enterprise executive

After using the control variable method to increase the enterprise response perception, the accountability of corporate executive in the corporate force, and the impact of the event on the core competitiveness of the enterprise, respectively, by 30%, there is a decrease in the peak of the negative public opinion and a delay as shown in the Figure 4, and the peak of the positive public opinion increased and advanced as shown in the Figure 5. The curves according to the peak in Figure 4 from top to bottom represent the negative public opinion in the situation of decreasing the accountability of enterprise executive by 30%, the initial condition and increasing the accountability of enterprise executive by 30%, respectively. Figure 5 is the opposite. We use the impact of events on the core competitiveness of enterprises and the accountability of corporate executive on positive and negative public opinion as an example.

After a crisis event, companies often expel the employees involved in order to distance themselves from matters, which often becomes a place for media criticism. While the enterprise takes the responsibility of management initiatively, properly handles the employees involved, and reflects the humanized management, which often plays a good role in guiding positive public opinions. Based on the results of the survey, we set the initial value of each component of the firm's strength to five. After raising the high-level responsibility attitude by 30%, the negative public opinion of the company has

declined, and the highest level of the heat of positive public opinion is higher than the initial situation. After reducing the high-level accountability attitude by 30%, the negative public opinion of the company increased. The time when the positive public opinion exceeded the negative public opinion was about 2 hours later than the initial situation, and the highest point of the heat of positive public opinion was lower than the initial situation.

If a service-related company has problems with its products, netizens tend to forgive the company; while service-related companies have problems with their services, netizens tend not to forgive the company. Therefore, the extent or degree of impact of the crisis events on the core competitiveness of enterprises will have a significant impact on public opinion. The simulation results show that enterprises need to improve the overall force of the enterprise by at least 20% in order to achieve the desired effect by adopting a combination of various countermeasures.

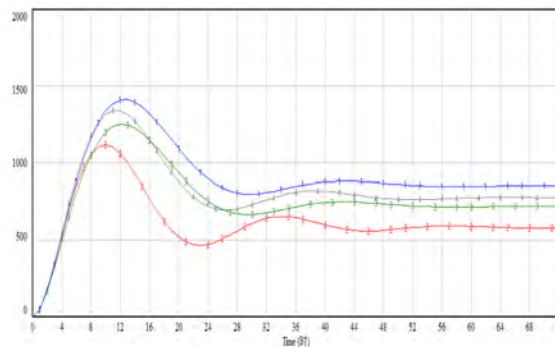


Fig. 6 Sensitivity of factors influencing negative public opinion

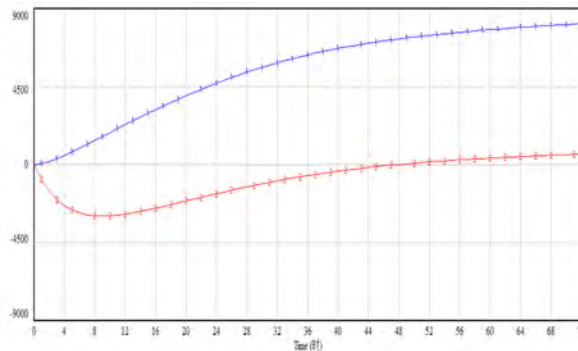


Fig. 7 Positive and negative public opinion when the measures are insufficient

Within the sensitive ranking of factors that affect public opinion, the accountability of enterprise executive is the most sensitive factor in the reaction, followed by the attitude of admitting mistakes, response speed, the publicity degree of information, and appointing responsible person. The highest curve in Figure 6 represents the initial situation, the second highest curve denotes increasing the accountability of enterprise executive, the third highest curve represents decreasing the impact of the event on the core competitiveness, the lowest curve represents decreasing corporate response perception. It can be concluded that for the negative public sentiment of corporate crisis events, the most sensitive factor is the corporate response perception, followed by the impact of the event on the core competitiveness, and the accountability of enterprise executive.

If a company does not take any measures or take insufficiently after a crisis event, the negative public opinion will occupy a dominant position, far exceeding the positive public opinion, and ultimately obtain a poor response effect that the enterprise hopes not to obtain, as shown in Figure 7. The higher curve in Figure 7 represents the negative public opinion trend. However, as the company's influence increases, the negative public opinion will gradually decrease, and the positive public opinion will gradually increase until it is dominating, and it will evolve into a trend chart of the "Mouse Scandal". This is also the reason why many enterprise crisis events have not responded well and have significant differences with Haidilao.

## 4. Conclusion

This paper uses the combination of system dynamics and sentiment analysis to study the mechanism of network crisis in enterprise crisis events, and focuses on the factors that influence the positive and negative network public sentiment of crisis events. The paper has the following conclusions. According to the observation of the simulation curve, the positive and negative network public opinion heat is generally 1 to 3 days from the outbreak to the recovery, and it quickly reaches its climax on the first day of the event exposure. This trend is consistent with the "Mouse scandal" incident. In today's big data era, the Internet has massive amounts of information every day, which shortens the network public opinion cycle for a single event. If the company cannot deal with it in a short period, the negative public opinion will eventually prevail, leaving the netizens with the impression that the company's incident response ability is poor, which seriously damages the brand image of the company.

Therefore, enterprises should first reduce the threshold of their response perception, to deal with public opinion in the "golden four hours". Secondly, the accountability of enterprise executive plays an important role in the reversal of sensational sentiment. Once a crisis has occurred, showing the public a sense of responsibility for the event instead of pushing responsibility on employees indicates the humanity management of a company. This makes it easier for companies to get the understanding of the majority of netizens and the positive reports of the media, which will ultimately help the company to win the rapid cooling of negative public opinion and the more lasting positive public opinion heat. Then, companies should pay attention to the areas of core competitiveness, and try to ensure that there are no serious problems in core competitiveness. If a company's crisis events involved its core competitiveness, the negative sentiment will be higher than it is not. The need to calm down or reverse negative sentiment requires companies to pay more, make greater efforts, and may even fall into an irreparable danger. Finally, from the overall impact of enterprise response, companies need to rank different types of crisis events and determine the enterprise force that each level of event should achieve. This will help the company to quickly understand what kind of countermeasures should be taken and how to guide positive public opinion, to achieve a good response.

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