

Formation Mechanism and Prevention Mechanism of Urban Emergencies

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Abstract: With the development of modernization and urbanization, the economic and productive activities of people in cities continue to expand, and cities are playing a greater role in people's lives. At the same time, bad factors in cities are born, resulting in urban emergencies becoming more and more frequent. Therefore, the prevention and management of urban emergencies become more and more important. This paper firstly analyzes the inducing factors of urban emergencies, and interprets the main inducing factors of urban emergencies from three levels. Secondly, social combustion theory and system dynamics theory are used to construct the formation mechanism of emergencies, and the main mechanism of urban emergencies is analyzed from the three perspectives of "combustion substance", "combustion promoter" and "ignition temperature". The feedback loop of organization management, public satisfaction and public opinion is obtained from the cause-and-effect diagram. Thus, it qualitatively describes the formation of urban emergencies. Finally, this paper puts forward prevention strategies for urban emergencies from three aspects: reducing internal and external contradictions, strengthening public opinion supervision and science popularization education ability, and enhancing the establishment of risk assessment mechanism. It provides a way to maintain the security and stability of the city.

1. Introduction

Emergency management of emergencies is a continuous concern of the country, in 2022, The State Council issued the "14th Five-Year Plan" National Emergency System Planning, for the "14th Five-Year Plan" period of work safety, disaster prevention, mitigation and relief for a comprehensive deployment, indicating the overall requirements of China's emergency system planning. With the rapid economic development in our country, the role of cities in carrying social development is also increasing. With the rapid development of urbanization, potential crises and hidden dangers in cities are gradually growing. In recent years, urban emergencies occur frequently, which to a great extent restrict economic development, hinder social progress and affect social stability. In order to cope with urban emergencies, clarify the formation mechanism of urban emergencies and establish a sound emergency response mechanism, this paper starts from the causes. Social combustion theory and system dynamics are used to analyze the formation

mechanism of urban emergencies, and how to prevent emergencies according to the formation mechanism, and the corresponding measures are put forward.

The definition of an emergency vary from country to country. The European Court of Human Rights considers an emergency to be an imminent crisis or significant event that is likely to have an impact on society as a whole. The United States defines an emergency as a major event declared by the President of the United States, occurring on any occasion and under any circumstances, anywhere in the United States that requires the intervention of the federal government to provide supplemental assistance to assist state and local governments in saving lives, ensuring public health, safety, and property, and mitigating or deflating the threat posed by a disaster. In the National General Emergency Response Plan for Public Emergencies promulgated by The State Council of China, public emergencies are defined as emergency events that occur suddenly, cause or may cause heavy casualties, property losses, ecological environment damage and serious social hazards, and endanger public security.

According to the occurrence process, nature and causes of emergencies, China mainly divides urban emergencies into four categories: natural disasters; accidents and disasters; public health events and social security events. Natural disasters mainly include flood and drought disasters, meteorological disasters, earthquake disasters, geological disasters, Marine disasters, biological disasters and forest grassland fires and so on. Accidents and disasters mainly include production safety accidents, transportation accidents, public facilities and equipment accidents, environmental pollution and ecological damage events. Public health events mainly include infectious disease outbreaks, group diseases of unknown cause, food safety and occupational hazards, animal outbreaks, and other events that threaten public health and life safety. Social security events mainly include terrorist attacks, the accidents of economic security and foreign-related emergencies^[1].

In addition to the abruptness, harm, destructiveness and uncertainty of general emergencies, urban emergencies also have complexity and public diffusion. Its complexity is reflected in the fact that the city itself is a complex complex, so the causes of emergencies are also complicated, and various elements interact and influence each other, which is easy to produce a "butterfly effect" when a crisis occurs, resulting in the generation of secondary crises. Its public diffusion is reflected in the fact that as the gathering place of mass production and life, the occurrence and impact of emergencies cannot be separated from the public. Urban emergencies not only have adverse effects on public facilities and public order, but also harm the interests of the public.

2. Causes and Formation Mechanism of Urban Emergencies

The formation of urban emergencies is a process of slow accumulation and final outbreak. In this paper, it is necessary to analyze the causes of urban emergencies first, and then use the social combustion theory and system dynamics theory to further analyze, so as to construct a formation mechanism of urban emergencies.

2.1. Causes of Urban Emergencies

Inducement refers to the factors that may directly or indirectly lead to the formation of emergencies and increase the frequency of urban emergencies or the severity of consequences. There are many types of urban emergencies with strong complexity and different causes, but there are still general rules. This paper mainly divides the causes of urban emergencies into three categories: management incentives, environmental incentives and public incentives.

(1) The inducement of management level: a. Management system; b. Management ability of managers; c. Prevention capacity of relevant departments; d. Manage the soundness of the organization.

(2) The inducement of environmental level: a. Social atmosphere; b. The contradiction between economic development and environmental protection; c. Potential economic crisis and international conflict; d. The community of the city; e. Production facility safety; f. Abrupt change in the natural environment.

(3) The inducement of public level: a. The generation and dissemination of public opinion; b. Public satisfaction; c. Public awareness of prevention; d. Emotional opposition between groups.

Figure 1 shows the classification of causes of urban emergencies. There are many internal factors in the city, the degree of system overlap is high. The external environment is complex and unpredictable. Therefore, urban emergencies are related to multiple incentives rather than the result of a single incentive.

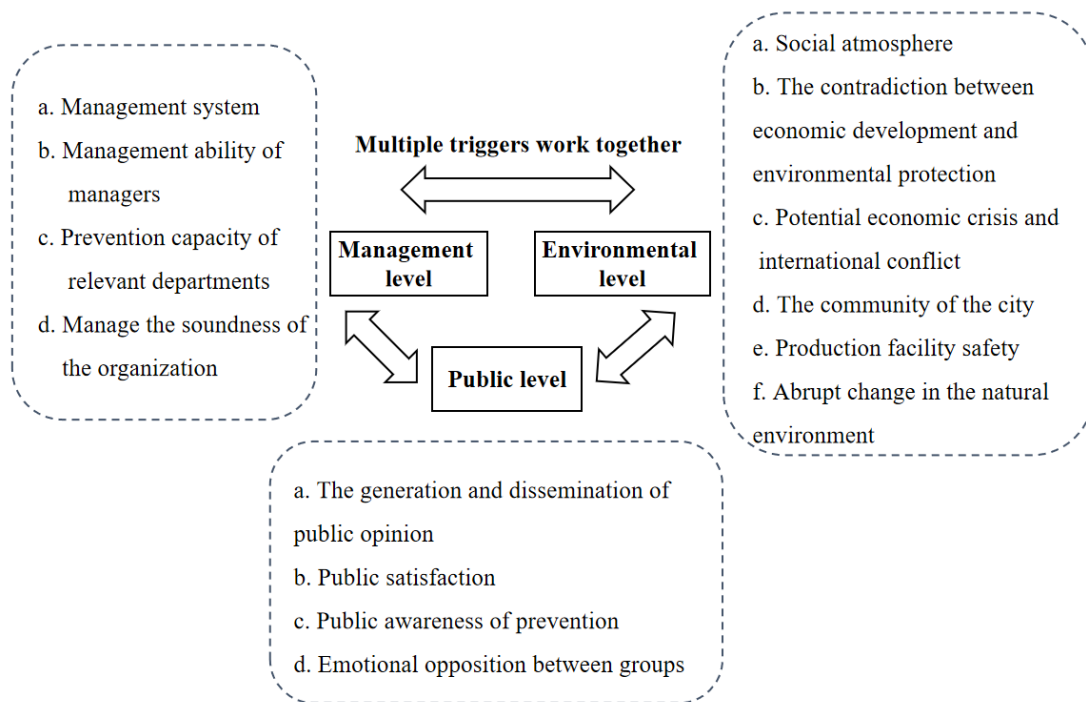


Figure 1: Classification of causes of urban emergencies.

2.2. Formation Mechanism of Urban Emergencies Based on Social Combustion Theory

Social combustion theory holds that combustion in nature requires combustion substance, combustion promoter and ignition temperature, all of which are indispensable. The theory makes an analogy between the disorder in society and the burning in nature, and regards the disharmony of the relationship between "man and nature" and the disharmony of the relationship between "man and man" as "burning matter". Some media's misdirection, excessive exaggeration, provocation out of thin air, the spread of rumors, the popularity of gossip, hostile malicious attacks, irrational inference, the deliberate pursuit of one-sided interests, and the random amplification of social psychology is regarded as "combustion promoter", and sudden events with a certain scale and impact are regarded as "ignition temperatures"^[2].

The social combustion theory emphasizes the sudden occurrence of "ignition temperature", which is consistent with the sudden occurrence of urban emergencies. The formation process of urban emergencies can also be analyzed from this perspective according to the combustion substances, combustion supporting factors and ignition temperature mentioned in the social combustion theory, so as to understand the formation mechanism of urban emergencies and build a reasonable coping mechanism.

2.2.1. "Combustion Substance"—a Collection of Unstable Elements in a City

The operation of a city is related to all aspects of the city, and the disharmonious factors in any small subsystem will affect the normal operation of the whole system. The interaction and mutual influence among many subsystems, if there is a contradiction, it will largely form an invisible "hydrogen balloon" in the air over the city. It is easy to be ignited. For urban emergencies, most of the uncoordinated factors are contradictions in production and life.

First, the disharmony caused by the rapid economic development and the transformation of economic structure. If the excessive pursuit of economic development ignores factors that are harmful to society, harmful factors will spread in the city and gradually form risk entities that can be ignited. For example, in the process of economic development, land degradation events and chemical gas leakage events caused by the neglect of the degree of damage to nature will destroy the ecological balance to a certain extent and affect the lives of the masses. This has created discontent among the masses.

Second, the potential conflicts within the city. First of all, due to the group character of the city, the organization and management within the city becomes more and more important management is to integrate the resources in the city efficiently and with high quality. If there is any problem in management, it will easily lead to public dissatisfaction, resulting in opposition between groups, and "chain reaction", which will bring instability to the city. Secondly, as an important complex nowadays, cities, while undertaking global political and economic activities, are also pregnant with potential economic crises and international conflicts and disputes. These adverse factors will also cause instability and disharmony within cities. Finally, cities are places of many production activities with abundant and advanced production equipment. The safety hazard in the use of equipment is a major problem in the production process, if it cannot be solved, it will cause the accumulation of crisis factors.

Third, the complex environment outside the city. The harsh environment in nature or around the city is a symbol of the complex environment outside the city. The existence of the harsh environment is contrary to the direction of the development of the city, and it is an unstable collection lurking around the city, which is also one of the challenges faced by the urban development.

2.2.2. "Combustion Promoter"—Irrational Distorted Judgment

Combustion promoter is mainly reflected in the management of public opinion and the judgment of the public.

The Internet age has accelerated the formation of combustion promoter. According to the 51st Statistical Report on the Development of the Internet in China, as of December 2022, the number of Internet users in China is 1.067 billion, and the era of Internet access has come. The rapid development of we-media has changed the subject of public opinion to the masses, and the spread of online public opinion has greatly accelerated the spread of rumors. In addition, due to the neighborliness and sociability of the city, the communication between people is more frequent, and the development of information technology brings information transparency, which promotes the malicious attacks of hostile forces. In the fast times, people no longer simply pursue the authenticity of events but pay more attention to the stimulation of public opinion, which easily leads to the distortion of information in the dissemination. Meanwhile, public opinion has become a weapon of interest in the new era, and both organizations and individuals will adopt the way of "public opinion war" to pursue their own interests. Therefore, the government's ability to control public opinion is also an important condition for determining whether public opinion, a combustion promoter, can be stable.

In addition to the reasonable control of the government, the judgment of the masses is also a major factor affecting the size of the "dose" of combustion promoter. In the face of mixed public opinion, the public is the main transmission carrier of such information. If the public can contain misleading information on its own propagation node through its own judgment and discrimination ability, which extinguishes a factor that may turn into combustion promoter. On the contrary, if the public carries irrational judgment, it is easy to accelerate the spread and diffusion of misleading information. That accelerates the production of combustion promoter.

2.2.3. "Ignition Temperature"—an Emergency that Breaks the Threshold

Under normal circumstances, we regard the ignition temperature as an unexpected event with a certain scale. For urban emergencies, the ignition temperature can be interpreted from both non-human and human aspects. Non-human perspective mainly refers to uncontrollable natural disasters and public health events, such as sudden floods, droughts, fires, thunderstorms, the emergence of new infectious diseases, the emergence of influenza. The human perspective is more complex than the non-human perspective, and it is also the main ignition temperature of many urban emergencies. From the human perspective, one is the major social events, such as major national decisions and the implementation of new policies; the other mistake of individual work and organization management, as well as the emotional confrontation caused by individual or organizational behavior. These errors and antagonisms can also be regarded as the ignition temperature of an emergency, which has an impact on the entire urban system. The focus of ignition temperature is sudden, and the cause of urban emergencies can be considered as the accumulation and expansion of disharmonious factors from point to surface, from small to large, and finally break through the critical value and "ignite", forming an emergency that endangers urban development. Different emergencies have different ignition temperatures, and their breakthrough thresholds are not the same.

The formation of urban emergencies is closely related to combustion substances, combustion promoter and ignition temperatures, which is independent of each other and do not affect each other, but all change with time. The theory of social combustion points out that the occurrence of urban emergencies does not depend only on a certain factor, its formation process goes through many aspects and a long time, and finally produces a sudden outbreak. For cities, the instability brought by the internal and external environment of cities and the rapidly developing economy is the main combustion substance. These combustion substances bury the fundamental factors for urban emergencies and form different ignition temperatures under different environments, while the combustion promoter increases the ignition temperature. If the city fails to respond in time, the combustion substance will be eliminated in advance. Weakening the role of the combustion promoter and reducing the ignition temperature will easily break the steady state of the city, that is, burning substances will be ignited and urban emergencies will break out.

2.3. Formation Mechanism of Urban Emergencies Based on System Dynamics

The emergence of urban emergencies is a result of strong causal effect, and generally it is a cyclic process of stability, outbreak and recovery. As for the formation of urban emergencies, different types of emergencies have different causes, and all kinds of causes influence and interact with each other, and the formation process is very complicated. Therefore, this paper mainly considers the human-caused emergencies, constructs the formation mechanism of system dynamics, describes them by system dynamics tools, and establishes the causal relationship diagram. As an important means to explore the feedback structure of the system, the causality diagram is a graphical model that qualitatively describes the causality relationship among variables in the system

[3]. As shown in Figure 2, the causality diagram of the formation mechanism of urban emergencies visualizes the process of urban emergencies so as to better analyze their influencing factors.

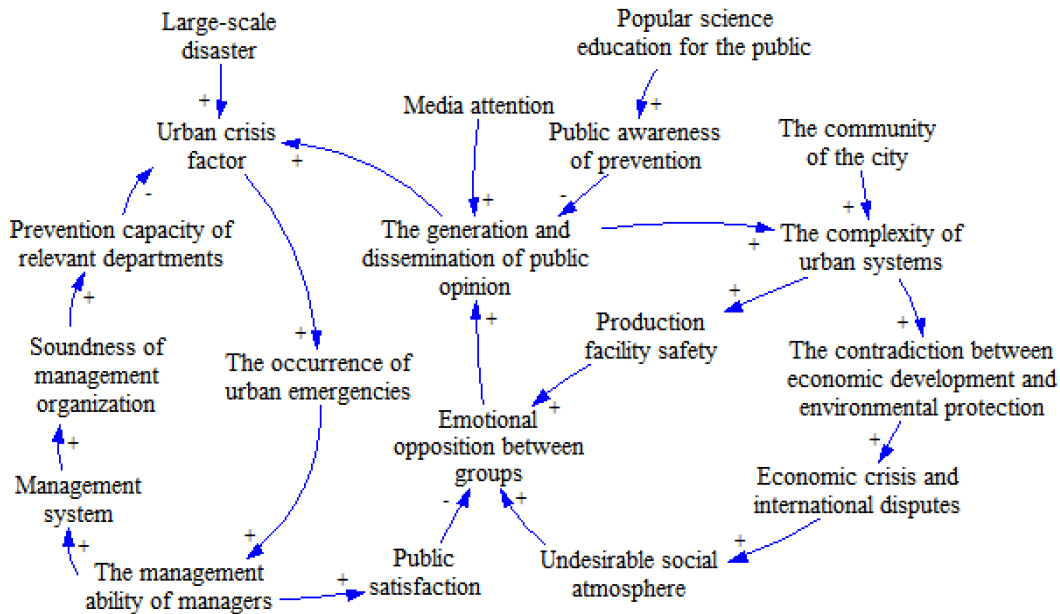


Figure 2: Causality diagram of formation mechanism of urban emergencies.

System dynamics says that the properties and behavior of a system depend on the feedback loops that exist in the system. The process of self-control, self-adaptation and self-equilibrium of system dynamics model is realized through the feedback structure^[4]. There are three main feedback loops in this cause-and-effect diagram:

(1) Organizational management feedback loop. Managers' ability to manage emergencies can promote the improvement of management system and the management organization, improve the prevention capacity of relevant departments, thus reducing the urban crisis factor and the possibility of urban emergencies. On the contrary, if the organization is not properly managed, there will be barriers between upper and lower levels of information communication, and the organization's risk prevention and control ability is insufficient. Without the corresponding management mechanism construction, it is easy to cause the disorder of management, trigger the disharmony factor, and thus have the opportunity to take advantage of emergencies. In addition, urban emergencies can help management departments to sort out their own shortcomings, improve the internal management, and enhance personnel management capabilities to a certain extent.

(2) Public satisfaction feedback loop. The management department can improve its management ability and solve public problems in a timely manner, which can improve public satisfaction, weaken the public's negative emotions, and alleviate the emotional confrontation between groups. On the contrary, the outburst of public emotions increases the possibility of public opinion, thus increasing the urban crisis factor and increasing the possibility of urban emergencies. The occurrence of emergencies improves the management ability of managers to a certain extent.

(3) Feedback loop of public opinion. The outbreak of public opinion will also increase the urban crisis factor, resulting in the emergence of emergencies. On the one hand, enhancing popular science education for the public can improve the public's awareness of prevention, reduce irrational judgments by the public, and thus reduce the generation and dissemination of public opinion. On the other hand, the popularization of the Internet has accelerated the development of media, and mobile terminals have become an important carrier of public opinion. The rise of the we-media industry has also made public opinion diversified and popular. Mass public opinion information on the Internet is intertwined, and the opinions and emotions of relevant stakeholders can easily lead to the generation of false information. The alienation and distortion of public opinion information is

inevitable, thus giving birth to network rumors^[5]. In addition, public opinion is related to the complexity of the urban system. In recent years, industrialization and urbanization have continued to advance. Cities, as the main production and living areas of people today, have the characteristics of a group of residents. As the main body of economic, technological and cultural development, cities play an important role in the development of countries and regions. It is precisely because of the complexity of the urban system that all kinds of social problems and conflicts in the international situation are easy to occur and form a bad social atmosphere, leading to the opposition of inter-group emotions, further promoting the generation and dissemination of public opinion, and the emergence and spread of public opinion also greatly contributed to the complexity of the urban environment.

In addition to the three feedback loops, large-scale disasters will also lead to the rapid and large increase of urban crisis factors, mainly referring to man-made safety accidents. If such events are not controlled by relevant departments, it is easy to lead to secondary events.

3. Preventive Strategies for Urban Emergencies

The formation of urban emergencies is complicated. According to the formation mechanism and related factors of urban emergencies obtained from the above analysis, this paper mainly puts forward corresponding countermeasures and suggestions from three aspects.

3.1. Reduce Conflicts Inside and Outside the City

For urban emergencies, burning material is a major risk for emergencies. Curbing the formation of burning material can effectively prevent the occurrence of emergencies, and numerous contradictions inside and outside the city can be understood as one of the reasons for the generation of burning material, and it can be seen from the causal diagram that many contradictions in the city are the main reasons for emotional confrontation.

(1) Establish a sound risk management system. A sound management system is an important support to control the spread of crisis factors. The efficient operation of a city depends on high-quality management, and it is necessary to establish a sound risk management system. First, the government should set up a high-quality management team with solid foundation and development potential to solve many problems in the city and help eliminate bad factors in the city. At the same time, reasonable warning and preparation should be made for possible emergencies, and the possibility of their occurrence should be stifled at the source, so as to avoid the subsystems in the city from stopping operation due to emergencies, so as to achieve the purpose of smooth operation of the entire urban system. Second, relevant departments should establish and improve relevant laws and regulations, achieve refined management of risk prevention and control, and achieve refined upgrading of urban risk management in the process of urban digital transformation^[6]. In a stable state of social operation, although social contradictions exist objectively, they can be "self-resolved" through a variety of channels, most of which are government-established appeal expression mechanisms^[7]. Third, social forces should be encouraged to join the government to help make up for the deficiencies in human resources and financial resources, so as to enhance the overall awareness of self-prevention and emergency management ability of the society.

(2) Optimize the social environment inside and outside the city. The social environment includes the natural environment, political environment, economic environment, etc. Sinister social environment is also a hotbed of contradictions. On the one hand, a special governance group should be set up to carry out different studies and analyses on environmental problems from different angles and different causes, and come up with corresponding improvement measures, combined with the suggestions of experts and people in society. So as to optimize the surrounding environment of the city and reduce the possibility of urban emergencies. The governance team also needs to investigate and predict emergencies, help relevant departments to coordinate, and improve

their coping capacity to emergencies. On the other hand, a platform for equal interaction and consultation among different stakeholders should be established. Such as hearings, symposiums, press conferences and other platforms to express their reasonable demands, ease the opposition of positions and emotions, and reduce the possibility of emergencies^[8].

3.2. Strengthen the Ability of Public Opinion Supervision and Popular Science Education

As the carrier of human society, city covers people's diversified thoughts and behaviors. In addition, development is irreversible, so it is difficult to fundamentally eliminate public opinion and irrational judgment in society. Weakening misleading public opinion and wrong judgment can reduce the role of combustion promoter and greatly reduce the crisis factor in the city.

(1) Improve the supervision ability of online public opinion. At present, many media gradually reduce their investment in traditional media and turn to online platforms, which is also one of the reasons for the fast spread and great influence of online public opinion. Therefore, the supervision of online public opinion is an important breakthrough. The supervision of Internet public opinion mainly needs to be carried out from two levels: theory and practice. On the theoretical level, the government must specify the purpose and principle of Internet supervision, provide clear direction and objectives, provide corresponding legal basis, and establish corresponding norms and systems. At the same time, it should pay more attention to regulators to prevent their slack and mistakes in work. Regulators not only need to clean up harmful information and punish relevant personnel, but also should effectively protect the information of ordinary netizens to reduce the possibility of public opinion infringement. When carrying out tasks, regulators should also pay attention to collecting problems downward and giving feedback upward, so as to improve the construction of the entire regulatory system and improve the efficiency of eliminating inappropriate remarks.

(2) Improve the judgment of the masses through popular science education. Increasing the publicity of scientific knowledge is the main way to improve the masses' ability to judge. On the one hand, we should carry out scientific publicity and education in places where public opinion is involved, help the masses to establish healthy, solid and correct ideas and value systems, actively cultivate the public's legitimate awareness of exercising rights, safeguard individual rights and interests must not harm the interests of the state, society and others, and at the same time establish a sense of rules, procedures and ethics. Abandon utilitarianism, extreme individualism and other value orientations, make the public consciously abide by the law and abide by moral norms as action consciousness in social life, enhance the awareness of crisis and legal consciousness of the masses^[9], form their own independent and healthy ideological system, do not follow the crowd, do not listen to the spread of misleading information, do not produce excessive negative emotional opposition. Speak out carefully with full knowledge of the facts^[10]. On the other hand, in the face of false and harmful information, government departments should refute rumors in time, thus preventing the spread of rumors, enhancing the credibility of mainstream media, and reducing factors of instability caused by public opinion.

3.3. Take the Initiative in Risk—Strengthens the Establishment of Risk Assessment Mechanism

Timely prevention and control of risk events can effectively reduce the ignition temperature in social combustion and reduce the bad factors in the city, and strengthening the establishment of risk assessment mechanism is an important breakthrough.

(1) Cooperate with expert teams to conduct scientific analysis and research. In order to establish a scientific and effective risk assessment mechanism, government departments should coordinate expert groups, adopt opinions from various parties, conduct scientific evaluation from the nature, size and frequency of risks, sum up experience from history, conduct specific analysis based on the existing situation, and then grasp the overall risk profile to prevent the occurrence of hazards. At the

same time, it is necessary to formulate many aspects and various kinds of emergency strategies in advance, so as to reduce the adverse impact of the incident on the city.

(2) Carry out specific work according to the actual situation of each region. The risk assessment mechanism not only needs to start from the main contradiction, but also must start from the actual situation in different regions. Therefore, each region needs to establish risk assessment teams according to the policy of development of our country and the different problems facing different regions. Carry out specific research on the actual situation of various regions, and put forward corresponding emergency plans, such as XX City (District) Emergency Risk Assessment Report, which can more effectively solve the problem of risk assessment in various regions, and the strategies generated are more targeted, which can help improve the prevention and emergency capacity of various regions. It reduces the adverse effects of risk factors to the greatest extent and maintains the stability of urban order.

4. Conclusion

The prevention of urban emergencies has always been attached importance by the state and the public, and the causes of them are complicated and hidden. Aiming at the causes of urban emergencies, this paper analyzes the social combustion theory and system dynamics, constructs its formation mechanism, and points out that urban emergencies are not caused by a single factor in many cases, but by the combined action of multiple internal and external factors in the urban system. The main factors are social contradictions, emotional antagonism caused by public opinion, lack of government organization and management ability and lack of crisis prevention ability. At the same time, aiming at the formation of urban emergencies, this paper puts forward corresponding preventive measures and suggestions to provide certain reference for maintaining urban security and stability.

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