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Research article

Research on public satisfaction of government typhoon emergency management under artificial intelligence: An empirical analysis based on Xuwen County

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Abstract: Typhoon natural disasters belong to one of the four major categories of public safety events. Typhoons have stochastic uncertainty and dynamic complexity, and frequent typhoons often cause heavy casualties and property losses in China's coastal areas, seriously affecting economic development and social stability. With the rapid development of artificial intelligence (AI) technology, intelligent disaster prevention and mitigation will become the trend of future development and a hot spot for research. Based on reviewing the current situation and trend of development, this study compares and analyzes the public satisfaction of communities using traditional technology methods and AI technology applications in typhoon disaster emergency management by constructing a public satisfaction model through the literature review, taking Xuwen County, China, as an example. The study shows that AI technology has an important role in the 3 main aspects of early identification, risk assessment, risk prevention and control, and provides a new technical approach to typhoon disaster

emergency management. Finally, we propose the construction scheme of the typhoon emergency management system based on AI.

Keywords: typhoon disaster; intelligent disaster prevention; AI technology application; public satisfaction mode; emergency management

1. Introduction

China is a country with frequent natural disasters. Various random and sudden disasters, such as forest fires, floods, urban meteorological disasters and urban geological disasters, have caused great damage to the ecological and living environment and also caused serious damage to the lives and properties of the people [1]. China is located on the west coast of the Pacific Ocean. Its unique geographical and climatic environment has caused it to suffer the most serious natural disasters, which mainly include typhoons and their resulting heavy rainfall, mudslides and tsunamis. This series of disasters seriously threaten China's socioeconomic development [2]. It also puts more pressure on the coastal governments at all levels to cope with frequent natural disasters. The impact of natural disasters mainly includes the following: First, they bring harm to people's lives, property safety and psychological health. Second, they are harmful to economic and social development. Third, they will endanger the political and social stability of the country. This paper is mainly based on grassroots government effectively improving public service satisfaction in the process of disaster management.

People's satisfaction with the government refers to a state of psychological identity held by the people based on their subjective cognition [3]. At present, the reform of national disaster prevention and mitigation institutions adheres to the hierarchical responsibility and focuses on territorial management. The central government plays an integrated guidance and support role. Party committees and governments at all levels are hierarchically responsible. The local is nearly mind, strengthens coordination, plays the main role, and assumes the main responsibility in disaster relief [4]. The report of the 19th National Congress proposes, "Integrating development and stability, strengthening awareness of potential dangers and living and working in peace and contentment is an important policy of our party in power." The factors affecting public safety are increasing day by day. They show the connection between nature and human beings, the interaction between tradition and the non-traditional, the interweaving of existing and new contradictions and the frequent occurrence, interweaving, overlapping and amplification of various types of emergencies, forming a complex and diverse chain of disasters and accidents and testing China's emergency management ability and social governance level. In the new historical position, we must be alert to the great dangers and challenges that remain in the future [5].

With the increasing emergence of new artificial intelligence (AI) technologies, the research of deep learning algorithms has good prospects for application in the meteorological big data environment. It has strong data learning capability and complex structural feature description capability. AI technology is compatible with the characteristics of emergency aggregation and is an important measure to achieve accurate emergency management.

The Fifth Plenary Session of the 19th Central Committee pointed out the need to strengthen the construction of a digital society and digital government, enhancing public services and social

governance, and other information technology [6]. Today, with the rapid development of information technology, China's emergency management is at a large stage. In recent years, with the rapid development of new generation technologies such as 5G, artificial intelligence, Internet of Things, big data, cloud computing and other emerging technologies, governments and enterprises are relying more and more on data, and data information is becoming an important strategic resource for emergency management departments. Data information is directly involved in the pre-research and pre-judgment of emergencies. Its quality will directly affect the effectiveness and efficiency of handling emergencies. Data quality is the key to improving the level of emergency management and informatization [7]. Predicting geological disasters successfully can significantly reduce casualties and loss of life and property, thus improving people's satisfaction with government services and establishing a sound relationship between the government and the people. Therefore, it is urgent and necessary to build a whole industry chain of "sensing, transmission, intelligence and application" of geological disaster monitoring and early warning systems [8].

The global pandemic that swept the world in 2020 significantly improved the national governance system and enhanced the government's ability to govern, particularly in emergencies [9]. With the development of society, there has been growing public participation and enthusiasm in government public affairs, and government services have increasingly focused on public satisfaction. However, the impact of the COVID-19 pandemic has also exposed deficiencies in the current development of digital governance. The digital infrastructure for governance is weak, and the awareness of basic digital government services lags. Public opinions on the introduction of digital technology into grassroots government work vary. Nevertheless, most studies indicate that digital technology can enhance the government's credibility and image in the public's perception. By leveraging the convenience, transparency and comprehensiveness of digital technology, government work can be streamlined, efficiency can be improved, and the transparency of government operations can be increased. Digital technology will transform the form of government service delivery, continuously deepen its functionalities and meet the individualized needs of the public. In the current social context, the rapid development of information technology has facilitated diversified social progress. Although society is developing rapidly, especially with dynamic economic advancements, there is a need to pay close attention to and be wary of risks. In the face of emergency management incidents, the government, as the policy maker for emergency management, must ensure that digital government services reflect the people's needs and meet the public's demands. Furthermore, focusing on the two domains of "AI + windstorm prevention and resistance" becomes an important factor in determining the effectiveness of emergency management incidents [10]. Currently, there are challenges in the application and development of AI in the field of emergency management. Therefore, paying attention to public satisfaction with digital technology applications in grassroots government emergency management work holds significant theoretical and practical significance.

Therefore, based on the 4R crisis management theory and the public satisfaction model, this study collected questionnaires on the public satisfaction of the grassroots government in the use of traditional technology methods and AI technology applications in typhoon disaster emergency management, taking Xuwen County, China, as an example. It further confirmed the necessity and progress of AI governance in the emergency management of typhoon disasters by grass-roots governments and its mediating role between grassroots government performance and public satisfaction.

2. Literature review

2.1. Theoretical basis

2.1.1. 4R Crisis Management Theory

The word "crisis management" simply means to prevent and avoid crises through crisis management, so that an institution or individual can survive the crisis and minimize the losses it causes. It mainly includes crisis management at national and governmental levels, crisis management implemented by international organizations or multinational joint organizations and global crisis management [9]. In terms of the scope of crisis management, crisis management encompasses the entire process of integrated crisis evolution as well as crisis management actions [10]. Robert Heath first proposed the 4R crisis management theoretical model of Crisis Reduction, Readiness, Response and Resilience in his *Crisis Management* book. For these four explanatory models, we can make the following preliminary explanations:

(1) Crisis Reduction: Crisis Reduction is at the pre-crisis stage and is the core stage in crisis management. During this phase, it is important to raise awareness of the crisis and identify potential risks through effective early warning strategies, communication skills, media coordination and other methods and actively seek ways to deal with it, thus greatly reducing the harm caused by the occurrence of a crisis.

(2) Crisis Readiness: Crisis Readiness is in the crisis stage. This stage aims to improve the crisis preparedness of organizations through crisis scenario early warning, personnel training and other work. It mainly includes crisis early warning and response. An emergency plan includes the development of a crisis management plan and the development of health and safety measures.

(3) Crisis Response: Crisis Response is in the crisis stage. This phase focuses on the response and movement of the organization in terms of prevention and control strategies, factor analysis, etc. after a crisis. Both the appropriateness and timing of response strategies are critical to success.

(4) Crisis Recovery: Crisis Recovery is in the post-crisis stage. This stage emphasizes the follow-up summary and reconstruction work when the crisis occurs and is effectively controlled. It will provide experience and support for recent crisis management.

This model was first applied to enterprise crisis management. It has been proven to be suitable for research in many fields due to its scientific nature and extensive practicability. Crisis management theory is equally applicable to crisis management in response to international sanctions.

2.1.2. Emergency management of grass-roots government

As the terminal of the whole emergency management system, the emergency management system of the grass-roots government is the cornerstone of the whole emergency management system. In recent years, major catastrophic and disastrous accidents have occurred in China. One of the major shortcomings of its prevention and disposal efforts is its weakness [11]. In the information age, data flow shows explosive growth. Digitalization brings challenges and opportunities to public management [12]. In the era of big data, data is no longer mainly from the government but can be collected from more diversified enterprises [13].

2.1.3. Public satisfaction with public services

With the rise of neoliberalism, the reform of the new public administration system, the evaluation of public service performance and the application of results have become hot topics in the research and practice of national governments and central and local governments. Past research has focused on the effects of different government performances on citizens' perceptions of government. However, the discussion on the correlation between civil servants' performance and citizens' satisfaction is as follows: First is the consistency between performance and citizens' satisfaction. The second is the question of the mechanism of the role of performance on national satisfaction.

2.2. Review of research

2.2.1. Relevant research of artificial intelligence in typhoon disaster emergency management

The key strategy to achieve the accurate management of emergencies is that the technical means of artificial intelligence fit the risk characteristics of the derivative cluster of emergencies. The precise management of AI response to emergencies is driven by AI technical means to achieve "efficient, high-precision and highly consistent coordination of problems and countermeasures, demand and supply, objectives and means" [14]. From the current research results, typhoon vortex identification, localization and intensity determination, path prediction and intensity prediction have gradually become hot spots for typhoon monitoring and forecasting in China. The future development direction may be mainly divided into three parts: cyclone monitoring application, typhoon forecast path optimization and sudden change of typhoon intensity forecast [15]. The combination of artificial intelligence in the future will certainly play a huge role in the real-time monitoring and even forecasting of typhoons.

This paper argues that a smart city is a new model of disaster management. It is mainly through the new generation of communication and digital technologies, such as the Internet of Things, cloud computing, big data, blockchain and Internet and other new generation information technologies, thus facilitating the transformation of urban disaster management [16]. For example, Amaravati, India, is located in the floodplain of the Krishna River, so it is susceptible to concentrated rainfall during the monsoon season, and the use of conventional impermeable measures can lead to increased traffic flow during the peak of heavy rainfall and thus cause flooding Amaravati to implement the "flood-free city" project, building a green roof, building new porous pavement, building a detention pond, using information and communication technology and so on [17]. The project has built a strong flood control system and carried out efficient and intelligent transformation in areas that may suffer from floods. The city of Higashi Matsushima in Japan is also actively using smart urban technologies, such as the use of vector supercomputers and high-performance computing technologies for information collection, analysis, intelligent warning and emergency response. The intelligent flood and tsunami early warning system developed by it can realize the inundation with damage prediction and provide the precise location of shelters within 20 minutes [18]. With the rapid development of big data, cloud computing, artificial intelligence and other fields, new information technology has brought great changes to people's lives, study and work and also provided a large amount of heterogeneous and

massive data for the city's emergency management system. Some scholars point out that artificial intelligence plays a larger role in urban management. It is mainly reflected in three aspects: front-end intelligence, back-end platform and system systematization. Specifically, artificial intelligence is used to target and track various activities and to analyze, judge, predict, forecast and warn about time, space and events in real-time. At the back end, all departments should strengthen the construction of emergency platforms, make full use of the advantages of cloud storage and combine network technology with network technology to build a good urban emergency platform. Therefore, it is an urgent need to establish an efficient and intelligent emergency management system.

Some scholars also pointed out that big data AI is an important condition to play the role of intelligence support in emergency decision-making. The rapid development of the Internet, the Internet of Things, mobile networks, RFID (Radio frequency identification), wireless sensors, wearable devices and other technological products has promoted the arrival of the "big data era." A large number of data can provide "full sample" data to support specific decisions [19]. Other scholars believe that the organic integration of information entropy, information technology and emergency operations to form a "preemptive" urban emergency warning system can be a useful tool [20].

Compared with the traditional risk analysis method, the traditional "disaster relief" mode is a passive emergency control mode. However, integrating AI into the management process of emergencies can accurately predict the risks of emergencies [21]. On a growing number of occasions, machines and information technology systems can make better decisions than people. China's emergency management system needs the support of technology and information technology, but further innovation is needed to consolidate grassroots facets. The mainly manifested as the low level of scientific and technological innovation in emergency management, especially the gaps in the "four precise" (warning release, rescue, and relief, recovery, and reconstruction, supervision, and enforcement) There is a shortage of preprofessional technical personnel, those who are interdisciplinary and multidisciplinary [22].

In summary, the existing research mostly starts from artificial intelligence in smart city construction, disaster prevention and control information warning and communication, risk research and judgment, etc., and it is less related to the government governance level and public satisfaction to establish a bridge.

2.2.2. Current situation of typhoon disaster emergency management of grass-roots governments

The grassroots government is the most important guarantee for preventing and resolving various emergencies and security risks, as well as for modernizing the national emergency management system and capabilities This process includes government emergency decision-making, information fusion, information collection and analysis, correction of bias in decision-making and other emergencies that need to be dealt with [23], and the completion of these tasks covers a combination of multiple disciplines such as information science, psychology, decision science, sociology, and ethics. However, there is not enough grassroots government in place to deal with these issues properly. At present, there are still the following problems in the treatment of various natural disasters and urban disasters in various regions: One is the lack of access to multi-source information resources in various periods before, during, and after the disaster, the lack of effective comprehensive integration and the lack of a

unified information platform to support the emergency management of multiple types of natural disasters. The second is that the level of technology and intelligence in emergency management is relatively low, and it is impossible to use modern technology for disaster emergency management, as well as the lack of information service platforms supported by artificial intelligence [24].

Taking typhoon Nida in Jinwan District, Zhuhai, in 2016 as an example, although the government made comprehensive deployments in terms of early warning issuance and personnel transfer command decisions, further improvements are needed in the construction of community-integrated command centers, monitoring and warning, image observation of emergencies, data analysis and information transmission so that remote analysis, command and dispatch, and rapid decision-making can be conducted promptly afterward to enhance the efficiency of emergency management [25].

In addition, in the process of building a grassroots government emergency management platform, some scholars believe that the current disaster information collection channels are still inadequate. However, from the current information collection and release, information collection is slow, information release is chaotic, and no authoritative and unified information release platform has been formed. The monitoring systems among various departments are not compatible with each other, lack synergy and cannot transmit and share effective information promptly. This also confirms the necessity of a series of works in AI governance, such as information environment, information communication, early warning research, and judgment, in government governance laterally.

2.2.3. Relevant research on the public satisfaction model

Public satisfaction model of American government services

The structure of the U.S. government service public satisfaction model includes the following six parts:

(1) Customer expectations: This refers to the expectations of product or service quality before receiving the product or service, including the prediction of the quality of the products or services that the company can provide in the future.

(2) Perceived quality: the customer's personal real feeling of the product or service quality after using and receiving the provided product or service for some time.

(3) Perceived value: This refers to the customer's evaluation of the product or service after considering the price and quality.

(4) Customer satisfaction: This refers to the degree of customer satisfaction, which is at the core of the model.

(5) Customer loyalty: This refers to a customer's sense of attachment to the company's products or services.

(6) Customer complaint: This refers to customer dissatisfaction with products or services. In addition, while the customer complaints, it also indicates that the customer is still waiting for the product service provider to improve its products and services.

Public satisfaction model of Chinese government services

Based on the theory and experience of foreign scholars, China should consider the following points when building the public satisfaction model: First, there are great differences between China

and Western countries in political traditions and cultural systems. Second, a series of models, such as ACSI, is the origin of tools used to evaluate enterprise customer satisfaction.

Based on the common satisfaction model ACSI, Shi Da (2006) identified seven structural variables: public expectation, perceived quality, perceived value, public satisfaction, public trust, public participation, and government image [26]. The analysis of the survey on the satisfaction of Hangzhou residents with the digital government shows that perceived quality and perceived value have a greater impact on public satisfaction, while public expectations have little impact on public satisfaction [29]. Based on SEM's public satisfaction model of government information service remediation, five variables were identified: public perception, public satisfaction, credibility, government image, and loyalty. The direct or indirect influence of each factor on satisfaction was analyzed. The perception of impartiality directly affects the evaluation of public satisfaction. In particular, the fairness of results and interactions has a greater impact on the evaluation of audience satisfaction, and satisfaction also directly affects the credibility and image of the government.

3. Problems of typhoon disaster emergency management of the grass-roots government in Xuwen County, China, based on the "4R model."

Based on the "4R model," this section chapter analyzes the main problems faced by emergency management in Xuwen County, China. Then, it analyzes the impact of emergency management on disasters and the public at different stages of the grassroots government. Through the investigation, we know that Xuwen County Government has set up an emergency response team and office to deal with natural events.

3.1. Reduction stage

3.1.1. Contingency plan performs practically no function

Although Xuwen County revised its contingency plan according to the previous approach, it only provided some staff updates without integrating the latest typhoon forecast with the latest requirements and taking into account the risks and further modifications to the project details. At 11:00 on October 16, Xuwen County Meteorological Station announced that typhoon "Nasha" (level 10) was expected to be influenced within 48 hours. The white typhoon warning signal in Xuwen County took effect. Affected by Typhoon "Nasha," a newly built building in a residential area in Xuwen County collapsed with bamboo frames on the exterior wall. However, it is far from enough to cope with the disaster degree with the previous emergency response measures. It is currently shown that the emergency management plan is not updated in parallel with the requirements of the new situation. Although the actual situation does not meet the conditions of the plan needed to activate the response governed by experience does not play the role of a willing plan. Some towns, streets and village communities have not implemented detailed specific work responsibilities, the focus of grass-roots emergency management work is missing, and a large number of basic emergency management work such as risk and hidden danger investigation, plan preparation, emergency drills, and publicity and education have not been effectively implemented at grass-roots level.

3.1.2. Lack of legal guarantee

At present, it can be seen from the defense against typhoons in Xuwen County that at the national level there is mainly the "Typhoon Disaster Management Emergency Response Law of the People's Republic of China," while Guangdong Province has promulgated the "Regulations on Flood and Drought Control and Wind Control in Guangdong Province." However, no laws have been enacted at the county level in this regard, and thus it lacks a relevant legal system to impose constraints on the different responsible parties in the emergency management process, increasing the resistance to emergency management.

3.1.3. Typhoons and heavy rains can easily cause a waterlogging disaster

According to a survey, most of the places where the residents of Xuwen County live are flooded during heavy rainstorms. It causes great concern among the residents.Flood disasters lead to the phenomenon of waterlogging black spots In Xuwen County, due to the lack of road drainage facilities, it is inconvenient for vehicles to pass when a rainstorm floods. Due to poor drainage facilities and topographical conditions, it is vulnerable to flood. Due to the low-lying terrain, the gates of primary and secondary schools are susceptible to flooding. No drainage facilities were built, and temporary drainage was not good due to construction, resulting in no drainage and waterlogging during heavy rainfall. These flooded black spots are inundated when it rains. Each time, a lot of manpower and resources are required for emergency rescue.

3.2. Preparation stage

3.2.1. Failure of local government early warning mechanism

The key to prevention is the timely identification of potential or imminent social crises that present social risk and the ability to take immediate and appropriate emergency measures to effectively stop and mitigate the impact of emergencies on affected groups. The grassroots government has not yet established a mature community crisis early warning system, resulting in inefficient emergency management in the preparatory phase. The early warning mechanism has not played a role, especially in the context of urbanization, where large-scale events often occur. The concept of "institutional rigidity" was originally intended to be easily and openly seen as the improper response of local governments to various social conflicts and their management. Especially at the beginning of a crisis and in cases of mismanagement of asymmetric or even distorted information, instead of easing conflicts and contradictions and reducing negative impacts, this has led to the expansion and outbreak of related conflicts.

3.3. Response stage

3.3.1. Emergency response of grass-roots government lack of professionalism

The grass-roots government's response to emergency groups at the crisis stage is inflexible, lagging and inefficient, mainly because the local governments are "slow" and lack comprehensive assessment of risk information before or at the beginning of the crisis. At the same time, there is a general lack of planning and prevention of preventable incidents by local authorities, leading to an inadequate overall response to unexpected mass incidents, as well as leading to an inadequate overall response, inadequate incident management and an inability to use the main conflict to resolve the crisis or to resolve or divert the conflict promptly.

3.4. Recovery stage

3.4.1. False information spreads rapidly on the network

China's Xuwen County has perennial heavy rainfall due to its terrain. Yet, someone posted photos of the early typhoon period in their circle of friends, and then the information spread rapidly, exponentially causing a determined panic. After investigation, the grass-roots government found that this was false information. Although confirmed to be false information, it also caused panic within a certain range.

4. Construction and hypothesis of the public satisfaction model for typhoon disaster emergency management work of the grassroots government in Xuwen County, China

Based on the research results of domestic and foreign scholars on public satisfaction and the characteristics of the typhoon disaster emergency management work of the grass-roots government in Xuwen County, China, there are four factors affecting the public's satisfaction with the emergency management work in this paper:

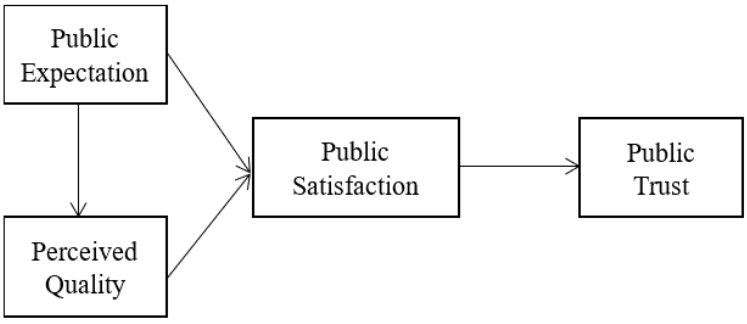

Figure 1. Public satisfaction model of typhoon disaster emergency management of grassroots government.

Table 1. Design of Variable Indicators.

Name of Variable	Measured indicators
Public expectation	1. Your expectation of the grassroots government's ability to provide emergency management services for similar natural disaster events before the latest typhoon.
	2. Your expectation of the items and types of emergency management services that the grassroots government can provide before the occurrence of the latest typhoon.
	3. Your expectation of the level of grassroots government emergency management services before the latest typhoon.
Perceived quality	4. After the latest typhoon, how satisfied you are with the timeliness of the grassroots government's emergency management response?
	5. How satisfied you are with the simplicity of the emergency management procedures of the grassroots government after the latest typhoon?
	6. How satisfied you are with the disclosure of information related to the grassroots government after the latest typhoon?
	7. After the latest typhoon, how satisfied are you with the timeliness of the emergency management responsibilities of the grassroots government?
Public satisfaction	8. When you asked the grassroots government about relevant issues after a recent typhoon, how satisfied you were with the speed of their response?
	9. After the latest typhoon, you think the grassroots government can actively use relevant intelligent means to effectively solve problems for you.
	10. After the latest typhoon, you think your daily life was protected by the efforts of the grassroots government.
Public trust	11. In the future, you are willing to continue to actively cooperate with the grassroots government in emergency management.
	12. In the future, you are willing to actively participate in the emergency management of the grassroots government.
	13. If another natural disaster occurs in the future, you are confident in the emergency management of the grassroots government.

4.1. Explanation of Variables

(1) Public expectation

Public expectation refers to the expectation of the public of the emergency management services provided by the grass-roots government for such events before the occurrence of natural disasters. It mainly includes the expectation of the emergency management serviceability of the grass-roots government, the expectation of the emergency management service items and types and the expectation of the level.

(2) Perceived quality

Perceived quality refers to the public's actual feeling of the emergency management level after experiencing the emergency management services of the grass-roots government after the outbreak of natural disasters. It mainly includes the timeliness of emergency management work response of the grassroots government, the simplicity of emergency management procedures, the degree of disclosure of relevant information and the efficiency of staff handling.

(3) Public trust

Public trust refers to the degree of trust of the public in the emergency management work of the grass-roots government after the occurrence of a natural disaster based on the satisfaction of the public based on the comparison between the expectation and the actual perception experience of the grass-roots government's emergency management work. It mainly includes the public's cooperation with the grassroots government's emergency management work, the public's willingness to participate in the grassroots government's emergency management, and the public's trust in the grassroots government's work in possible future natural disaster events.

(4) Public satisfaction

This refers to the public's overall evaluation of the emergency management work of the grass-roots government. Include the public's satisfaction with the services provided by the grass-roots government in emergency management.

4.2. Hypotheses of the study

In the ACSI model of the National Customer Satisfaction Index of the United States, Fornell believes that customer expectations and perceived quality have a positive impact on customer satisfaction. The public satisfaction model adopted by the US government is precisely this view. An empirical study by Sheng, Mingke, and Liu, Guizhong, (2006) on A municipal government in China confirmed that both public expectations and perceived quality have a direct positive impact on public satisfaction [27]. In a study on satisfaction with public cultural service delivery, Li Jinliang, Deng Ping & Yang Weiwu (2011) verified the positive effects of public expectations and perceived quality on public satisfaction [28]. Based on the existing research, combined with the characteristics of the research objectiveness of the theoretical model of this paper, the following assumptions are proposed as shown in Table 2:

Table 2. Hypotheses of the study.

	Hypotheses of the study
H1	Public expectation has a significant positive effect on perceived quality
H2	Public expectation has a significant positive effect on public satisfaction
H3	Perceived quality has a significant positive effect on public satisfaction
H4	Public satisfaction has a significant positive effect on public trust

5. Empirical analysis of public satisfaction with typhoon disaster emergency management work of grassroots government in Xuwen County, China

5.1. Design and distribution of the questionnaire

Based on a full review of relevant literature, this study summarizes and refines the measurement indicators. From Table 2, it can be seen that the model of public satisfaction with typhoon disaster emergency management work of grassroots government in Xuwen County, China, contains four variables. The questionnaire contains two parts: The first part is the basic information of the test taker,

including gender, age, education level, occupation and the number of years living in Xuwen County. The second part is the measurement of public satisfaction with emergency management of grass-roots governments. Public expectation, perceived quality, public satisfaction and public trust are measured on a five-point Likert scale with five options: very low, relatively low, average, relatively high, and very high. The measurement indicators of the model variables in this study are shown in the following table:

Table 3. Model variables measured in this study.

Primary Indicators	Secondary Indicators	Tertiary Indicators
Public satisfaction level of typhoon disaster emergency management work by grassroots government in Xuwen County, China	Public expectation	Expectations for the capacity of grassroots government emergency management and services
		Expectations of the programs and types of emergency management services of the grassroots government
		The expectation of emergency management service level of grass-roots government
	Perceived quality	Timeliness of emergency management response of grass-roots governments
		The simplicity of emergency management procedures
		The degree of disclosure of relevant information
	Public satisfaction	The response speed of staff
		Satisfaction degree of intelligence in solving problems
		Satisfaction degree of life security
	Public trust	The degree of public cooperation with the emergency management work of the grass-roots government
		The willingness of the public to participate actively in emergency management work of the grassroots government
		The degree of the public's trust in grassroots government emergency management during possible future natural disaster events

In light of the unique circumstances of epidemic prevention and control, this study employed a combined approach of online and offline questionnaire distribution methods. The online survey questionnaire was disseminated through platforms like QuestionStar and social media, where respondents were invited to participate. Additionally, a portion of the survey was conducted offline by directly distributing questionnaires at the entrance of the Xuweng County Government Service Center in China. Interviews and questionnaire completion were carried out with staff members and relevant individuals to gain a general understanding of the current state of typhoon disaster emergency management. The study also employed a screening process to ensure the authenticity and validity of the questionnaire by identifying eligible participants. Material incentives were provided to eligible participants to enhance the response rate. The formal survey took place from December 2022 to February 2023, involving two months of data collection, integration and analysis. A total of 300 questionnaires were distributed, and after excluding invalid responses, 214 valid questionnaires were obtained.

5.2. Descriptive Statistical Analysis

After collecting the public satisfaction questionnaire on the typhoon disaster emergency management of the grass-roots government in Xuwen County, China, the basic information of the respondents in the questionnaire was analyzed by descriptive statistics. From the age distribution level, the respondents were mainly distributed in 19–25 years old, with 59 people, accounting for 27.6%. There were 50 people aged 26–30, accounting for 26.6%. There were 45 people aged 31–40, accounting for 21%. There were 27 people aged 41-50 years, accounting for 12.6%. In terms of educational background, the respondents' education level is mainly high school and university undergraduate degrees. In terms of occupational background, the majority of respondents were engaged in self-employment, with 122 people, accounting for 57%. The next largest group was agricultural workers, with 51 people, accounting for 23.8%. In terms of the number of years of residence in Xuwen County, 19 people have lived there less than 1 year, accounting for 8.9%, and 45 people have lived there for 1–3 years, accounting for 21%. Meanwhile, 65 people have lived there for 2–5 years, accounting for 30.4%, and 85 people have more than 5 years, accounting for 39.7%.

5.3. Analysis of reliability and validity

To test the reliability of the questionnaire scales, SPSS was used to analyze the reliability of each dimension of the questionnaire scales. The results showed that the overall reliability of the 12 scale questions of the questionnaire was 0.909 > 0.7. Among the three questions of the public expectation dimension, Cronbach's Alpha was 0.727 > 0.7. Among the three dimensions of perceived quality, Cronbach's Alpha was 0.692, close to 0.7. Among the three dimensions of public satisfaction, Cronbach's Alpha was 0.707 > 0.7. Among the three dimensions of public trust, Cronbach's Alpha was 0.696, close to 0.7. The overall reliability and reliability of each dimension of the questionnaire are greater than or close to 0.7, which indicates that the reliability and internal consistency of the questionnaire are very good and suitable for the next step of factor analysis.

Table 4. Results of descriptive statistical analysis of respondents' basic information.

Property		Frequency	Percentage (%)	Cumulative Percentage (%)
Gender	male	104	48.6	48.6
	female	110	51.4	100
Age	under 18 years old	9	4.2	4.2
	19-25 years old	59	27.6	31.8
	26–30 years old	57	26.6	58.4
	31–40 years old	45	21	79.4
	41–50 years old	27	12.6	92.1
	over 50 years old	17	7.9	100

Continued on next page

Property		Frequency	Percentage (%)	Cumulative Percentage (%)
Education	junior high school and below	28	13.1	13.1
	senior high school	20	9.3	22.4
	higher vocational college	77	36	58.4
	undergraduate	86	40.2	98.6
	graduate and above	3	1.4	100
Occupation	government institutions	14	6.5	6.5
	enterprise managers	26	12.1	18.7
	self-employed	122	57	75.7
	agricultural and forestry practitioners	51	23.8	99.5
	others	1	0.5	100
Number of years of residence in	less than 1 year	19	8.9	8.9
Xuwen County	1–3 years	45	21	29.9
	2–5 years	65	30.4	60.3
	more than 5 years	85	39.7	100

Table 5. Table of reliability analysis.

Test of the reliability of the questionnaire		
Dimension	Item	Cronbach's Alpha
Overall Questionnaire	12	0.909
Public Expectation	3	0.727
Perceived Quality	3	0.697
Public Satisfaction	3	0.707
Public Trust	3	0.696

Table 6. Validity analysis.

KMO and Bartlett Test		
KMO Sampling Suitability Quantity		0.926
Bartlett Sphericity Test	Approximate cardinality	1132.879
	The degrees of freedom	66
	significance	0.000

The data validity test on the questionnaire data yielded a KMO of 0.926, which is greater than 0.9. The Bartlett sphericity test approximate chi-square was 1132.879, with significance indistinguishably close to 0 and less than 0.05, indicating that there was a significant difference between the correlation coefficient matrices of the data questionnaire measures. This indicates suitability for exploratory factor analysis, and the questionnaire validity test is very good.

An exploratory factor analysis was performed on the questionnaire data using the principal component extraction method. From the table, the cumulative variance explained by 1 common factor is 50.131% > 50%, so the information extraction rate is qualified, and the loss of information is low.

Table 7. Interpretation of total variance.

Total Variance Explanation						
Component	Initial Eigenvalue			Extract the Sum of the Squares of the Load		
	Total	Percent Variance	Cumulative %	Total	Percent Variance	Cumulative %
1	6.016	50.131	50.131	6.016	50.131	50.131
2	0.845	7.038	57.168			
3	0.741	6.175	63.343			
4	0.667	5.555	68.898			
5	0.622	5.182	74.08			
6	0.587	4.89	78.97			
7	0.541	4.505	83.475			
8	0.487	4.058	87.533			
9	0.476	3.966	91.499			
10	0.384	3.199	94.698			
11	0.372	3.098	97.796			
12	0.264	2.204	100			

5.4. Regression analysis and hypothesis verification

The results of correlation analysis on public expectations, perceived quality, public satisfaction and public trust are as follows:

(1) Public expectation and perceived quality showed a significant positive correlation at the 0.01 level, with a correlation coefficient of 0.709, and the significance p value was $0.000 < 0.05$.

(2) There was a significant positive correlation between public expectation and public satisfaction at 0.01 level, the correlation coefficient was 0.711, and the significance p value was $0.000 < 0.05$.

(3) There was a significant positive correlation between public expectation and public trust at 0.01 level, with a correlation coefficient of 0.744, and the significance p value was $0.000 < 0.05$.

(4) Perceived quality and public satisfaction showed a significant positive correlation at 0.01 level, the correlation coefficient was 0.735, and the significance p value was $0.000 < 0.05$.

(5) Perceived quality and public trust had a significant positive correlation at 0.01 level, with a correlation coefficient of 0.969, and the significance p value was $0.000 < 0.05$.

(6) There was a significant positive correlation between public satisfaction and public reliability at 0.01 level, the correlation coefficient was 0.759, and the significance p value was $0.000 < 0.05$.

Table 8. Correlation analysis.

Correlation of Each Dimension					
		Public Expectation	Perceived Quality	Public Satisfaction	Public Trust
Public Expectation	Pearson correlation	1			
	Sig. (twin-tailed)				
Perceived Quality	Pearson correlation	.709**	1		
	Sig. (twin-tailed)	0.000			
Public Satisfaction	Pearson correlation	.711**	.735**	1	
	Sig. (twin-tailed)	0.000	0.000		
Public Trust	Pearson correlation	.744**	.696**	.759**	1
	Sig. (twin-tailed)	0.000	0.000	0.000	

**At 0.01 level (twin-tailed), the correlation is significant.

Based on the correlation analysis, the correlation of each variable is significant at a high level. The following research hypotheses were proposed, and the regression test was carried out on the research hypotheses. The results are as follows:

H1: Public expectation will have a significant positive impact on perceived quality

Set the public expectation as the independent variable and the perceived quality as the dependent variable, and carry out regression analysis to get the results:

(1) In Table 9, the coefficient of determination $R^2 = 0.503 > 50.0\%$ indicates that the independent variable in the regression equation explains 50.3% of the information of the dependent variable. DW value is 2.029, which is close to 2, indicating that there is no sequence correlation between variables, and the data is independent. Since $R^2 = 50.3\%$ is greater than 50%, the regression model is judged to be a good fit. The ANOVA results of the regression model showed that the overall regression of the model was significant at 0.000, the F-value was 214.804, the overall regression was significant, and the regression model was valid.

Table 9. Model Fitting.

Table of Regression Model Fitting Indicators							
Model	R	R2	Adjusted R-side	Error in Standard Estimation	Durbin-Watson	F	Significance
1	.709a	0.503	0.501	0.496	2.029	214.804	0.000

The hypothesis of the results in Table 10 shows that the independent variable public expectation has a significant positive effect on the dependent variable perceived quality with a significant p-value of $0.000 < 0.05$ and a regression coefficient β of 0.727, which means that the higher the public expectation is, the better the perceived quality. Therefore, research hypothesis 1 (public expectation has a significant positive effect on perceived quality) is valid.

Table 10. Regression Coefficients.

Coefficient a								
Model		Unstandardized Coefficient B	Standard Error	Standardized Coefficient Beta	t	Significance	95.0% Confidence Interval of B Lower Limits	Upper Limits
1	(Constant)	0.928	0.186		5.001	0.000	0.562	1.294
	Public Expectation	0.727	0.05	0.709	14.656	0.000	0.629	0.825

H2: Public expectation has a significant positive effect on public satisfaction

H3: Perceived quality has a significant positive effect on public satisfaction

Regression analysis was conducted by setting public expectation and perceived quality as independent variables and public satisfaction as dependent variables. The following results were obtained:

(2) In Table 11, the coefficient of determination $R^2 = 0.613 = 61.3\%$ indicates that the independent variable in the regression equation explains 61.3% of the information of the dependent variable. The DW value was 2.164, which is close to 2, indicating that there is no sequence correlation between variables, and the data is independent. Since the $R^2 = 61.3\%$ was greater than 50%, the regression model was judged to be a good fit. The ANOVA results of the regression model showed that the overall regression of the model was significant at 0.000, the F-value was 167.157, the overall regression was significant, and the regression model was valid.

Table 11. Model Fitting.

Table of Regression Model Fitting Indicators							
Model	R	R-side	Adjusted R-side	Error in Standard Estimation	Durbin-Watson	F	Significance
1	.783a	0.613	0.609	0.427	2.164	167.157	0.000

The hypothesis of the results in Table 12 shows that the independent variables public expectation and perceived quality have a significant positive effect on the dependent variable public satisfaction with a significant p-value of $0.000 < 0.05$, and the regression coefficient of public expectation β is 0.382. The higher the public expectation is, the better the public satisfaction will be. The regression coefficient of perceived quality β is 0.452. The better the perceived quality is, the better public satisfaction. Therefore, research hypotheses 2 and 3 (public expectations will have a significant positive impact on public satisfaction, and perceived quality will have a significant positive impact on public satisfaction) are tenable.

Table 12. Regression Coefficients.

Coefficient a								
Model		Unstandardized Coefficient		Standardized Coefficient	t	Significance	95.0% Confidence Interval of B	
		B	Standard Error	Beta			Lower Limits	Upper Limits
1	(Constant)	0.651	0.169		3.850	0.000	0.318	0.985
	Public Expectation	0.382	0.061	0.382	6.295	0.000	0.262	0.502
	Perceived Quality	0.452	0.059	0.464	7.633	0.000	0.335	0.569

H4: Public satisfaction has a significant positive effect on public trust

Regression analysis was conducted with public satisfaction set as the independent variable and public trust set as the dependent variable. The results were obtained. (3) In Table 13, the coefficient of determination $R^2 = 0.577 = 57.7\%$ indicates that the independent variable in the regression equation explains 57.7% of the information of the dependent variable. The DW value was 1.84, close to 2, indicating that there is no sequence correlation between variables and that the data is independent. Since the $R^2 = 57.7\%$ was greater than 50%, the regression model was judged to be a good fit. The analysis of the variance of the regression model shows that the overall regression significance of the model is 0.000, the F value is 288.974, the overall regression is significant, and the regression model is established.

Table 13. Model Fitting.

Table of Regression Model Fitting Indicators							
Model	R	R-sid	Adjusted R-side	Error in Standard Estimation	Durbin-Watson	F	Significance
1	.759a	0.577	0.575	0.439	1.840	288.974	0.000

Table 14 shows that the independent variable public satisfaction has a significant positive effect on the dependent variable public trust with a significant p-value of $0.000 < 0.05$ and regression coefficient β of 0.747. The better the public satisfaction is, the higher will be the public trust generated. Research hypothesis 4 (public satisfaction has a significant positive effect on public trust) holds.

Table 14. Regression Coefficients.

Coefficient a								
Model		Unstandardized Coefficient		Standardized Coefficient	t	Significance	95.0% Confidence Interval of B	
		B	Standard Error	Beta			Lower Limits	Upper Limits
1	(Constant)	0.865	0.165		5.254	0.000	0.54	1.19
	Public Satisfaction	0.747	0.044	0.759	16.999	0.000	0.66	0.834

Summary of research assumptions and Validation

A summary of the study hypothesis validation is shown in Table 15.

Table 15. Summary of study hypothesis validation.

Evaluation of the Results of the Study Hypotheses		
The Hypothesis of the Study		Evaluation of results
H1	Public expectation has a significant positive effect on perceived quality	valid
H2	Public expectation has a significant positive effect on public satisfaction	valid
H3	Perceived quality has a significant positive effect on public satisfaction	valid
H4	Public satisfaction has a significant positive effect on public trust	valid

6. Research Conclusions and Countermeasures

6.1. Discussion

6.1.1. AI technology research in the field of public administration

In recent years, there have been increased research efforts and investments in AI [30], particularly in exploring its potential in handling public administrative data [31]. However, extensive discussions on these issues within the public sector seem to be lacking. Unlike the business sector, the adoption of AI in public administration is still in its early stages. Therefore, our study does not aim to explore new avenues for AI but rather focuses on its impact on resident satisfaction, providing new perspectives and insights into enhancing government trust [31]. It is important to acknowledge the coexistence of risks and opportunities. AI offers significant opportunities for public administration, such as workflow automation [32], faster information processing, improved service quality and increased work efficiency [9]. Governments and public administration agencies increasingly recognize the importance of AI for economic and social progress, applying it to administrative management, public infrastructure and supporting research. However, public administration struggles to keep pace with the rapid development of AI, lacking specific governance and legislative measures. Issues related to AI governance and regulation have been widely overlooked, hindering comprehensive resolutions in public administration research [33]. Additionally, the relationships between AI and age groups, professions and educational levels vary, and research findings do not explicitly reflect their opinions on the application of AI in disaster management.

Emergency management of typhoon disasters is a common challenge for coastal regions worldwide. Looking beyond the technological aspects, the integration of AI technology with governance and citizen participation is predicted to be inseparable in the future of public administration. This integration becomes a necessary path for governments facing similar challenges. Therefore, our study will provide theoretical and practical support for integrating and developing AI governance, grassroots government construction and citizen satisfaction.

6.1.2. The universality of technology application

The application of artificial intelligence in typhoon emergency management has a certain degree of universality, but there are key points that need to be considered differently when implemented in different regions. Here are some key points that may require differentiated explanations for different regions:

(1) Meteorological data: There may be differences in the sources, quality and accuracy of meteorological data in different regions. Some regions may have more comprehensive and accurate meteorological monitoring and forecasting systems, while others may face challenges in data acquisition and quality. Therefore, when establishing artificial intelligence models, appropriate adjustments and validations need to be made based on the meteorological data situation in different regions.

(2) Infrastructure and resources: There may be differences in the infrastructure and resource situations in different regions. Some regions may have advanced communication networks, sensor devices and logistics systems, while others may face issues of inadequate infrastructure or resource scarcity. When developing artificial intelligence plans for typhoon emergency management, it is necessary to consider and adapt to the local infrastructure and resource conditions.

(3) Risk assessment and warning systems: Different regions may have different risk assessment and warning systems. Some regions may have well-established risk assessment and warning systems, while others may still be in the development stage. The application of artificial intelligence in typhoon emergency management needs to be customized based on the risk assessment and warning systems of different regions to ensure their effectiveness and accuracy.

(4) Community participation and cultural factors: Community participation is crucial in typhoon emergency management. There may be differences in community structure, cultural habits and population density in different regions. Therefore, the AI plan needs to consider the characteristics of the local communities and formulate corresponding participation strategies. In some regions, close cooperation with local communities is needed to ensure their understanding and acceptance of the application of artificial intelligence technology.

In summary, although the AI plan for typhoon emergency management has a certain degree of universality, it requires differentiated explanations and customization based on the characteristics of different regions during implementation. This will help ensure the effective application of artificial intelligence technology in typhoon emergency management and safeguard the safety of people's lives and property.

6.2. Conclusions of the study

This paper constructs a satisfaction model based on four factors that affect the public's satisfaction with emergency management, namely, public expectation, perceived quality, public satisfaction, and public trust, of the characteristics of typhoon disaster emergency management work of the grassroots government in Xuwen County, China. Through the distribution of questionnaires and data collation, we further explored the relationship between the typhoon disaster emergency management work of

grass-roots governments and public satisfaction under the background of AI applications. This study found the following.

Firstly, through the survey we found that public expectations have a significant positive impact on perceived quality and public satisfaction. A questionnaire was distributed to members of the public who have lived or are living in Xuwen County to collect their level of expectation of the grassroots government's emergency management service capability during similar natural disaster events through the provision of emergency management service items, types, etc.. This study finds that public expectations will have a significant impact on the quality of public perceptions and public satisfaction. That is, public expectations of government emergency management services will have a significant impact on the public's actual perceptions of the level of emergency management after they have experienced grassroots government emergency management services after a natural disaster event outbreak. At the same time, it also affects the public's overall evaluation of the emergency management work of the grass-roots government.

Then, perceived quality has a significant positive effect on public satisfaction. That is, the public's expectation of the emergency management services that the grassroots government can provide in response to such events, such as the government's working ability and service level, before the occurrence of natural disaster events also has a significant relationship with the public's evaluation of the grassroots government's emergency management work.

Finally, public satisfaction will have a significant positive impact on public trust. The public's satisfaction with the services provided by the grass-roots government in emergency management will greatly affect the public's trust in government management and services, including the public's trust in the future emergency management of the public, cooperation and enthusiasm to participate in the government's emergency management.

With the increasing emergence of new artificial intelligence (AI) technologies and in the context of big weather data, this study has obvious implications for the use of AI technologies to improve the disaster emergency management capabilities of grassroots governments and thus promote public satisfaction and trust in government work. Improving public satisfaction with government emergency management services often relies on more scientifically sound government services and governance. Traditional models often may not do much to improve citizen satisfaction. However, if AI governance is actively introduced, with scientific prediction, prevention and management, the damage caused by natural disasters will be greatly reduced. At the same time, it will also effectively enhance citizens' satisfaction with the government's emergency governance work, thus establishing a more harmonious and perfect relationship between the government and the people and promoting the grassroots government to further improve and enhance its governance capacity.

6.3. Measures to improve public satisfaction with typhoon disaster emergency management of grass-roots governments under the background of AI

Based on the 4R crisis management theory, this study analyzed the main problems faced by emergency management in Xuwen County, China, analyzed the impact of the local government's management of emergencies on disaster development at different stages and found that the development of natural disasters is subject to the process of emergency management by the local

government at different stages. It is not difficult to find that the traditional governance model in the four stages of crisis reduction, crisis preparation, crisis response and crisis recovery has many problems such as lagging information and insufficient scientific management. Obviously, with the rapid rise of artificial intelligence (AI) technology, the use of meteorological data for prevention and management will greatly improve the local government's emergency management capabilities and services when natural disasters occur, thus effectively increasing the local public's satisfaction with the work of the grassroots government. Therefore, this paper proposes the following recommendations:

(1) Estimate risks and establish plans. The typhoon disaster emergency management work of the grassroots government should be combined with the front-end typhoon detection technology so that the details of the typhoon disaster management plan can be further modified based on the latest typhoon forecast situation and the latest requirements to anticipate the risks. In addition, scientific data and analysis are used to emphasize the seriousness of disasters and to force the establishment and improvement of local laws and regulations, thus providing basic legal protection for citizens and enhancing their trust in the government.

(2) Scientific statistics and timely warnings. The study found that the main problem in Xuwen County was the failure of local early warning systems. Use smart city technology actively. For example, use vector supercomputers and high-performance computing technology for information collection, data analysis, intelligent early warning and emergency handling. This can enable the government to actively predict an early warning before the crisis, effectively reduce disaster risk, improve public trust and improve its management level.

(3) Timely response and precise control. Enhance the level of technology and intelligence of the government in the process of emergency management in the approach of typhoons, with the help of the latest technology for disaster relief and emergency management and with the help of artificial intelligence technology-assisted information technology service platforms to achieve real-time monitoring and uploading of information, thus maximizing the ability and speed of rescue and treatment and reducing casualties. Effective governance will greatly enhance citizens' trust in the government and increase their satisfaction with the government's work, build a more harmonious relationship between the government and the people and help citizens support and participate more in the government's work.

(4) Scientific assessment and effective recovery. The disaster recovery phase is often not given much attention, but its impact on post-disaster reconstruction and citizens' trust in government is enormous. The grassroots government should reuse artificial intelligence technology. The problems existing in the prediction, early warning and prevention stages of scientific assessment have not been used for reference in disaster management. In addition, use information collection and processing tools and effectively prevent and control the spread of false public opinion to create a good information environment and reduce public panic, thus helping the government to further govern.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

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