Corporate crisis management from a strategic operations perspective: the importance and impact of information management

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ARTICLE INFO	ABSTRACT
	Corporate crisis management is important and influential from a strategic operations perspective, and information management plays a key role in crisis management and is critical to the success and sustainability of a company. This study aims to explore the importance of information management in corporate crisis management from a strategic operations perspective and its impact on companies. Firstly, this paper provides an introduction to crisis management, focusing on the dynamic process of crisis development, including the prevention, identification, handling, and aftermath of crises. At the same time, this paper provides an in-depth introduction to the importance and key elements of corporate crisis information management. In the section on information management, this paper compares the key elements of data collection and analysis, information dissemination and communication, and decision support, and introduces the challenges faced by contemporary enterprise crisis information management. Finally, this paper proposes an early warning model for enterprise crisis information management based on theories related to data analysis. The early warning model is built from three aspects: users, data, and applications, and the indicators of enterprise crisis pressure table are obtained, through which the possibility of an enterprise crisis and the impact value of the crisis on the enterprise can be seen more subjectively and corresponding measures can be taken. **Keywords:** Corporate Crisis Management, Strategic Operations Perspective, Information Management, Decision Support.

INTRODUCTION

In the process of creating and operating enterprises, there are endless kinds of crises, and some experts say that in today's society, enterprises are either in the midst of a crisis or have already experienced a crisis but are meeting a new one (Helm & Tolsdorf, 2013; Simola, 2003; Pang, Cropp, & Cameron, 2006; Kirkpatrick, 2009; Kim & Cameron, 2011). Robert Heath, a British crisis management expert, describes in his book: "A crisis is a scenario with serious threats, uncertainty and a sense of crisis" (Heath, 1998); Feam Banks believes that a crisis is a major event that could have a potentially negative impact on an organisation, business or industry and would impact on the normal operation of the organisation and may threaten its survival (Fearn-Banks, 2016). For a business, a crisis is a situation in which the business operation is in a particular state that leads to damage to the interests of the business, unsustainable business operations or a large shock. An enterprise crisis can be defined as an event with a high degree of uncertainty caused by uncertain factors in the business process, and the enterprise needs to use enterprise resources to deal with it within a limited period of time.

With the emphasis on crisis management research, management scholars have proposed two classic theoretical models of crisis management that have been widely circulated: Steven Finker's "five-phase" theory, which divides corporate crisis management into five phases: prevention, preparation, reaction, recovery, and learning (Fink & American Management Association, 1986); and Robert Heath's 4R model (Relevancy, Reaction, Relationship, Reward) (Heath, 1998). In crisis communication, scholars have also put forward the main principles of crisis response in different dimensions, including (Wang & Luo, 2012;

Scholes, 2016): the "3C" principle, which is communication-based; the "5S" principle, which is attitude-based; and the "3T" principle, which is action-based. The "3Ts" principle is an action-oriented approach.

The discipline of crisis management was first born in the field of public administration, but as research deepened, scholars crossed over with management, political science, economics, psychology and sociology, and the scope of crisis management research expanded rapidly into the field of business administration. In 1993, for example, I.I. Mitroff and others wrote an article in which they clearly stated that the collection and dissemination of information was the primary task in crisis management (Mitroff, Shrivastava, & Udwadia, 1987). In 1996, W.A. Wagenaar published an article in which he carried out an in-depth analysis of the issue of crisis information management (Wagenaar, 1996). In 1997, O. Lerbinger used the information perspective as an entry point to analyse the qualities and responsibilities of crisis managers (Lerbinger, 1997). In 1998, C.M. Pearson and other scholars discussed measures to deal with corporate crises and carried out an in-depth study of information strategies (Pearson & Clair, 1998). In 1999, W.T. Coombs published an article analysing the information needs of crisis management activities and summarising the continuity of crisis management approaches (Coombs, 2000). In 2003, R.M. Negin published an article focusing on the qualities and roles of crisis managers, with an emphasis on information skills and the education and development of crisis information managers (Doughty, 2000; Negin, Mills, & Bärnighausen, 2012).

Information management is the basis for the economic activities of enterprises. The daily business development of enterprises is based on industrial development, industrial policies, consumer demand and other factors. Enterprise crisis management is also a part of the daily management of enterprises, which is the process of information transfer, information collection and confirmation, information understanding and analysis, as well as the process of reaction and processing according to the collected information. Enterprise information management is the basis and premise of enterprise crisis management (Ponis, & Koronis, 2012; Wang & Belardo, 2005; Wang & Belardo, 2009; Wang, 2009). Robert Heath and others have shown that if there is a lack of effective information during a corporate crisis, rumours can cause the corporate crisis to increase further and in severe cases make corporate crisis management impossible (Heath, 1998). In practice, each stage of a corporate crisis contains a great deal of information. (Jasko, Popovic, & Prokic, 2012; Li & Wang, 2009; Van De Walle, Turoff, & Hiltz, 2014; De Long & Seemann, 2000).In the information management of corporate crises, it is necessary to effectively organise all the information management work in crisis management and make full use of the relevant information resources (Lee, Hirschmeier, Müller, & Luz, 2017; Schulz, Paulheim, & Probst, 2012; Jin, Liu, & Austin, 2014).

Michael Porter, in his research on strategic management,

once clearly proposed that the strategic management process is a process of value transfer, and through the use of value chain analysis, it is possible to find the monopoly nodes that exist in the economic process, and through the analysis of the internal and external environment, it is possible to help the company find the right monopoly position for itself in the industry, in order to obtain excess profits and make the company more competitive (Porter, 1981). This shows that there is a certain systematic and global nature to strategic management. By systematically analysing the internal and external environment in which the company is located, and by formulating long-term development goals based on the company's strengths and stage characteristics, the implementation and control of the strategic goals are clearly defined and complement each other to form a complete and systematic strategic management integration. Strategic management also needs to have the appropriate corresponding dynamic, after the establishment of enterprise strategic objectives, in the process of specific implementation, enterprises must be closely combined with the industry market environment, macroeconomic and other changes in trends, and even their own business strategy and business adjustment direction, the enterprise's original development strategy to make appropriate adjustments and optimization, which is also the process of dynamic management of enterprises (Artto & Dietrich, 2007; Cokins, 2017; Armistead, Pritchard, & Machin, 1999).

At this stage, the society has fully entered the new media era, the speed of information dissemination is accelerated, and the information coverage is wide and involves many fields, the information management under the enterprise crisis is facing a major challenge. How to cope with enterprise crisis and realize better sustainable development is a strategic decision-making problem that enterprise operators must think about, therefore, this paper carries out the research of enterprise crisis management under the strategic perspective: the importance and impact of information management, and puts forward the enterprise crisis early warning model to help enterprises carry out the enterprise crisis management work efficiently.

CRISIS MANAGEMENT OVERVIEW
Definition and Characteristics of Crisis Management

Crisis management is the preparation and contingency measures that companies take to deal with various unexpected events and difficulties. Corporate crises can come from a variety of causes, and the goal of crisis management is to minimise the adverse effects on the business. Simply put, crisis management is about companies preparing for and minimising losses in the event of emergencies and difficulties in order to protect themselves. Many experts have summarised and discussed crisis management models, among which Robert Heath's 4R theory has been widely used and disseminated. The 4R model refers to the four elements of Relevancy, Reaction, Relationship and Reward, which run through the entire process of crisis control, and its model is shown in **Figure 1**.
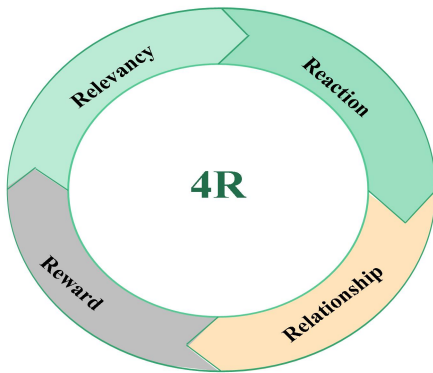
Figure 1. 4R Model

Crisis management has the characteristics shown in **Table 1**.

Table 1. Crisis Management Characteristics

Features	Details
Sudden	Crises usually arise in a sudden and unpredictable manner, causing unexpected shocks and distress to the business. They may be caused by internal or external factors and usually require rapid action when they occur.
Uncertainty	Crisis events are often uncertain and complex. Businesses may face insufficient information, tight timelines and uncertain environmental factors, which add to the challenge of crisis management.
Diversity	Crises come in many forms and from many sources, including natural disasters, human error, financial risk and so on. Companies need to be able to respond to all types of crises and develop crisis management strategies accordingly.
Public Attention	Crisis events usually attract widespread public attention, especially when it comes to aspects such as personal safety, environmental protection or social responsibility. Crisis management should take into account the public interest and reaction, and take active measures to maintain public trust and reputation.
Sustainability	Crisis events can have a long-term impact on a company and even pose a threat to its survival and growth. Crisis management therefore needs to focus not only on emergency response, but also on post-crisis recovery and long-term development. This includes the follow-up assessment of the crisis, organisational learning, repairing damage, resuming operations and rebuilding reputation.
Multi-level	Crisis management involves cooperation and coordination at multiple levels and departments. It requires leadership and decision-making by senior management, as well as collaborative work across departments. Information sharing and communication play a key role in crisis management, ensuring that all parties involved are kept informed of the crisis and the response.

Crisis management is characterised by suddenness, uncertainty and multiplicity. The definition and characteristics of crisis management further highlight its importance and complexity. In today's ever-changing business environment, companies need to establish sound crisis management mechanisms to protect their interests, improve their response capabilities and maintain good relations with their stakeholders. Comprehensive planning, preparation and coordination are needed to ensure that companies can operate stably, respond quickly and recover effectively in the face of a crisis.

Crisis Management Process

Crises are unavoidable risks in the business environment and can have serious damaging and negative effects on a company. No matter how well a business is run, a potential crisis cannot be completely eliminated.

Crisis management is a series of management measures taken to protect the corporate image, deal with the crisis and carry out aftercare when an unexpected crisis event is encountered in the course of business. Crisis management mainly includes crisis prevention, crisis identification, crisis handling and crisis aftermath. Crisis in an enterprise is a dynamic process. Firstly, there is the crisis prevention phase, which mainly takes prior management measures. This includes rehearsing possible crises, reserving crisis resources, establishing a sound crisis management mechanism and providing crisis management training for employees. The second stage is the formal exposure phase of the crisis, which requires ex-post management, i.e. crisis management. In this stage, the crisis has already occurred and has caused a certain negative impact on the enterprise. Crisis management measures include initial control of the crisis situation, prevention of further spread of crisis information, development and implementation of a crisis management plan, and evaluation of the crisis event. Finally, there is the crisis repair phase, i.e. post-event management. In this phase, the focus is on crisis repair management. Companies need to take steps to restore their damaged image and reputation, repair their relationships with stakeholders, as well as learn from the crisis to avoid a recurrence of similar crises. The main measures taken include: a comprehensive summary and reflection on the crisis event, the repair of the damage already caused, the implementation of the management plan to repair, etc. The dynamic process of corporate crisis development is shown in **Figure 2**.
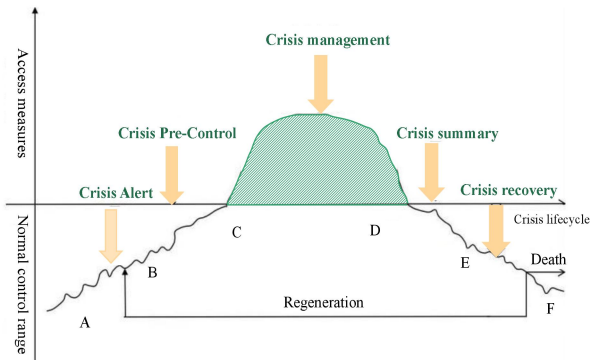
Figure 2. The Dynamic Development Process of a Corporate Crisis

Crisis Management in a Strategic Operational Perspective

Corporate crisis management is a set of measures and strategies developed and implemented within the framework of strategic operations. These measures and strategies are designed to respond to and manage various types of crises in order to ensure business continuity and sustainability of the company.

In a strategic operational perspective, the focus of corporate crisis management is on preventing crises from occurring. This means that companies need to identify potential crisis factors through risk assessment and early warning mechanisms, and adopt appropriate prevention strategies. Preventive measures may include improving production processes, strengthening supply chain management, enhancing product quality and safety, etc. Through prevention-led crisis management, companies can reduce the likelihood of a crisis occurring, reduce potential losses and improve overall operational efficiency.

In addition, in a strategic operational perspective, crisis management requires agility and flexibility. Crises come in a variety of nature and forms, so companies need to be able to adapt and respond quickly. This requires companies to have flexible organisational structures and processes to enable them to make quick decisions and adjustments when a crisis occurs. In addition, companies should have the market acumen and strategic judgement to be able to adjust their strategic direction in time to adapt to changing circumstances. Through such agile and flexible crisis management, companies can better respond to crisis challenges and maintain a competitive advantage.

Finally, continuous evaluation and improvement is essential in crisis management from a strategic operations perspective. Companies should regularly evaluate the effectiveness and implementation of their crisis management strategies, identify problems and bottlenecks, and take corrective measures in a timely manner. This can be achieved through regular crisis drills and simulations, post-evaluation and learning. Continuous evaluation and improvement help companies to continuously optimise their crisis management processes, strategies and capabilities, and improve the effectiveness and efficiency of their crisis response.

THE IMPORTANCE AND IMPACT OF CORPORATE CRISIS INFORMATION MANAGEMENT

In today's uncertain and risky business environment, companies are exposed to a variety of possible crisis events.This section will introduce the concept, importance and impact of corporate crisis information management and explore how to manage crisis information at the strategic and operational levels.

The Concept of Corporate Crisis Information Management

I. The Concept of Enterprise Crisis Information Management

Enterprise crisis information management refers to the management process of comprehensive, timely and accurate collection, analysis, processing and dissemination of information related to crisis events when a crisis occurs. It includes crisis early warning, information collection and analysis, crisis decision-making and response, information dissemination and communication, etc.

II. Crisis Early Warning

Crisis early warning refers to the monitoring and analysis of environmental changes, risk factors and potential threats to predict and identify in advance the signs and warning signals that may lead to a crisis. Enterprises can use various information sources and tools, such as public opinion monitoring, market research and risk assessment, to obtain and analyse relevant information in real-time, so as to detect potential crises early and make corresponding preparation and response plans.

III. Information Collection and Analysis

Information collection and analysis is one of the core aspects of enterprise crisis information management. When faced with a crisis, timely and accurate collection and analysis of relevant information is essential for corporate decision-making and response measures.The types of information on corporate crises are shown in **Figure 3**.
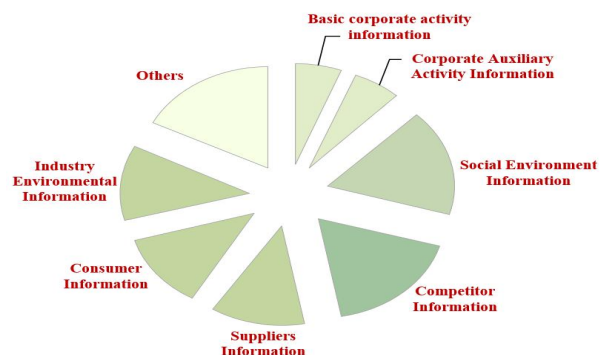

Figure 3. Types of Corporate Crisis Information

IV. Crisis Decision-making and Response

In the crisis information management process, enterprises need to make informed decisions based on the information collected and take corresponding response measures. This

requires comprehensive consideration of the severity, potential impact and feasibility of the crisis, as well as the formulation of corresponding crisis management strategies and action plans. The decision-making and response process requires efficient coordination and communication to ensure that people from all departments and levels can work closely together.

The Importance of Enterprise Crisis Information Management

In today's business world of change and uncertainty, companies can be exposed to a variety of potential crisis risks. In order to survive and progress in this environment, companies must manage crisis information effectively.

I. Timely Identification of Potential Crises

One of the importance of corporate crisis information management is the ability to detect potential crises in a timely manner. By establishing an effective information collection and monitoring mechanism, enterprises can obtain a variety of internal and external information in real-time, and analyse and evaluate it. Doing so helps to detect potential signs of crisis and early warning signals, so that timely measures can be taken to avoid further deterioration and expansion of the crisis. In simple terms, corporate crisis information management is to help enterprises detect the signs of crisis as early as possible and then take appropriate measures to prevent the occurrence and expansion of the impact of the crisis. Timely identification of potential crises can gain valuable response time for enterprises and facilitate the adoption of appropriate countermeasures to minimise losses and negative impacts.

II. Comprehensive Assessment of the Crisis

Crisis information management can also help enterprises to conduct a comprehensive assessment of the crisis. This helps companies to formulate informed decisions and response strategies, and to take targeted and appropriate action. A comprehensive assessment of the crisis can also help enterprises better understand the root causes and development trends of the crisis, providing valuable lessons and references for future crisis management.

III. Effective Communication and Dissemination

Crisis information management plays an important role in crisis communication and dissemination. Crises are often accompanied by a large amount of information and communication noise. Companies need to establish effective communication channels and strategies to communicate crisis-related information in a timely and accurate manner and eliminate uncertainty and speculation. Through reasonable information dissemination and communication, enterprises can maintain public trust and support for the company and protect its reputation and image. At the same time, enterprises can also use effective crisis information management to convey positive information and response measures to resolve the negative impact of the crisis on the enterprise.

IV. Support for Decision-making and Response Measures

Crisis information management provides important support for decision-making and response measures. By collecting and analysing crisis-related information, companies are able to gain accurate data and insights that provide a strong basis and reference for decision-makers. This helps to make informed decisions and develop appropriate response strategies, thus improving the effectiveness and efficiency of crisis management. Crisis information management can also help companies identify possible risks and challenges, predict the likely course of a crisis and take proactive measures to mitigate its impact on the business before it occurs.

V. Establishing Learning and Improvement Mechanisms

Enterprise crisis information management can also help enterprises establish a learning and improvement mechanism. By collecting and analysing crisis-related information, enterprises can evaluate and provide feedback on the effectiveness of crisis management. This helps enterprises draw lessons, identify shortcomings and make necessary improvements and adjustments. Companies can improve their organisational sensitivity and response capabilities to crises by building a knowledge base, conducting training and drills. Continuous learning and improvement can make a company more adaptable and resilient in the face of future crises.

Based on this some scholars have proposed the five forces model of enterprise crisis management, as shown in **Figure 4**.
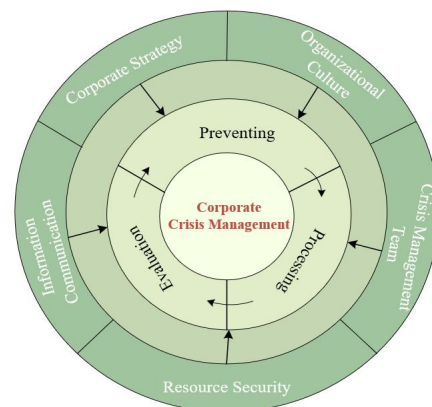

Figure 4. Corporate Crisis Management Model

Key Elements of Enterprise Crisis Information Management

The key elements of enterprise crisis information management are data collection and analysis, information dissemination and communication, and decision support, all of which are related to each other as shown in **Figure 5**.
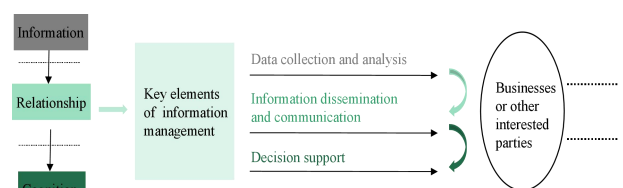

Figure 5. Key Elements of Information Management

Data Collection and Analysis

Data collection and analysis play an important role in

corporate crisis information management. When collecting data, companies need to consider the source, timeliness and accuracy of the data. Companies can collect internal information through employee feedback and combine it with external information obtained from market research for a comprehensive comparative analysis. Accuracy and reliability of data are essential requirements for data collection. Enterprises should ensure reliable data sources and accurate data content to avoid the impact of incorrect information. The use of scientific data collection methods and tools, such as questionnaires and statistical sampling, can help improve the accuracy of data. At the same time data collection should have breadth and depth. Breadth refers to the scope of data collected should cover multiple aspects, such as customers, suppliers, employees, markets, etc. Depth refers to the detailed collection and analysis of data on each aspect in order to gain a comprehensive understanding of all aspects of the crisis.

Key elements involved in conducting data analysis include the collation and cleaning of data, visualisation of data, analytical methods and forecasting. The data collected needs to be collated and cleaned to ensure its integrity and consistency. Data collation involves sorting, filing and coding data to make it easy to manage and analyse. Data cleansing removes noise and errors from the data to improve its quality. Data visualisation is the presentation of data in the form of charts and graphs, allowing companies to extract key information from large amounts of data, revealing relationships and trends between data and further providing an intuitive reference for decision making.Data analysis methods include statistical analysis, intelligence analysis and data mining. Statistical analysis can provide a quantitative description of a crisis situation by analysing the distribution, trends and relationships of data through statistical indicators and models. Intelligence analysis, on the other hand, collects, analyses and evaluates various types of intelligence to reveal the nature and motivation of crisis events.

Data mining is like using computer technology and algorithms to find treasures in vast amounts of data. It can help us to find hidden patterns and trends. Through data mining and analysis, we can use our past experience to predict possible future crises and can then take appropriate measures to avoid them. This can help us to manage crises better and reduce risks.

Information Dissemination and Communication Collection and Analysis

Information dissemination and communication play a key role in corporate crisis information management.

Key elements of information communication include transparency and timeliness, multi-channel communication and personalised communication, as well as communication of crisis response strategies. Companies should ensure that they are transparent and communicate relevant information to all stakeholders in a timely manner when a crisis occurs. Transparency increases public trust in the company and reduces speculation and rumours. At the same time, timely dissemination of crisis information can help stakeholders to take necessary measures and response strategies. Companies

should establish multiple channels of information dissemination to ensure that crisis information reaches different audience groups. This includes internal channels (e.g. employee newsletters, internal emails, meetings, etc.) and external channels (e.g. press releases, social media, official websites, etc.). Through multi-channel communication, companies can communicate crisis information more widely and increase the coverage and visibility of the message. Companies need to adopt a personalised approach to communication based on the needs and concerns of different audiences. Different audiences may have different concerns and needs about a crisis event, so companies need to target their messaging. Personalised communication can enhance the relevance and effectiveness of messages and improve audience understanding and recognition. In addition to communicating crisis information, companies should also communicate their crisis response strategies and measures. This includes the emergency measures taken by the company, the composition and responsibilities of the crisis management team, and the progress of crisis management. Communicating crisis response strategies can enhance public confidence in the company and reduce uncertainty and panic.

In the actual communication process of corporate crisis, the two-way nature of information, clarity, and communication methods need to be focused on control. The two-way nature of information means that in the process of transmitting information to the outside world, enterprises also need to accept feedback and suggestions from relevant stakeholders. Enterprises need to build a communication method for the public when they carry out crisis management, such as holding seminars, accepting media interviews or opening telephone hotlines and other ways of two-way information. When the enterprise obtains the opinions of relevant stakeholders through the above-mentioned channels, it will then respond and make adjustments to enhance the stickiness between the enterprise and users and increase user satisfaction. Also need to have clarity in crisis communication, enterprises must use clear and concise language to express when making external information delivery, and avoid using industry jargon or overly specialized language to avoid confusion and misunderstanding of the audience. The use of clear and concise language can effectively convey information and avoid unnecessary speculation and misunderstanding. In crisis communication, companies also need to pay attention to the management of emotions. In a corporate crisis, it is important for companies to handle the situation in a way that brings emotional uncertainty to users. When communicating, companies need to focus on expressing understanding and care for users, so as to alleviate their negative emotions. At the same time, if the user is accompanied by negative emotions and opinions, the company should also respond in a positive way to minimize the user's negative emotions. Finally, when communicating with users, companies can develop diversified communication methods, such as communicating with users through images, texts, videos, etc., to meet the different preferences of different users and improve the stickiness

between companies and users. By diversifying communication methods, companies can better communicate their messages and improve their accessibility and appeal.

Decision Support

Decision support plays a vital role in corporate crisis information management. In the event of a crisis, decision makers need accurate and timely information to make informed decisions and take effective action.

There are several key elements involved in decision support in an organization, including data collection and organization, data analysis and modeling, information visualization and reporting, decision assessment and risk analysis, etc. Most importantly, decision support relies on accurate and comprehensive data. In corporate crisis management, data collection and organization is the foundation of decision support. In order to make informed decisions, companies need to collect data about the crisis and organize it initially. Data collection includes determining the type, source and method of data to be collected and, most importantly, ensuring the accuracy and completeness of the data. Data analysis and modeling of the collected data are the core steps of decision support. By applying statistical analysis and data modeling techniques to the collected data, companies can extract useful information and trends from it and build corresponding models to understand the underlying correlations and patterns. The analysis of data and the models obtained can help decision makers better understand problems and come up with possible solutions, and ultimately companies make the right decisions based on the data. Information visualization and reporting is the way to present the analysis results and model outputs of the above steps to the decision makers. By presenting data and analysis results in a visual format (e.g. charts, graphs and dashboards), professionals can make it easier for decision makers to see the changing trends behind the data. It is also important for professionals to prepare clear and concise reports. The final step is that business decision makers make decisions, and the basis for making decisions is decision assessment and risk analysis. Before a business decision maker makes a final decision, different decision options need to be evaluated and risk analyzed to select the best decision. This includes the benefits, advantages and disadvantages between different decision options, and the decision maker selects the optimal decision for subsequent enterprise crisis management. Decision support needs to consider the advantages, disadvantages and risks of different decision options. By evaluating and comparing different decision options, the best decision path can be identified. At the same time, risk analysis can help decision makers identify and assess potential risks in order to develop appropriate risk management measures.

The Impact of Corporate Crisis Information Management

Improved Crisis Response and Reaction Capabilities

It is very important for companies to improve their crisis response and reaction capabilities when facing a crisis, which can help them better handle the crisis, reduce the negative impact caused by the crisis, and protect the interests of the company. First, crisis early warning and monitoring is the key. Enterprises need to establish an effective early warning system to detect signs of crisis and early warning signals in a timely manner. By collecting and analyzing relevant data and information, enterprises can realize the potential risk of a crisis earlier and be able to make timely responses. Second, it is necessary to establish a crisis management team. Also, developing a crisis management plan is an important step. Companies should develop a detailed crisis management plan in advance, including specific action steps and division of responsibilities. This will allow for quick action when a crisis occurs and reduce confusion and delays. It is also a key step for companies to make quick responses and decisions. When a corporate crisis occurs, corporate decision makers need to make quick decisions to control the expansion of the corporate crisis and the adverse effects it brings. Companies need to deploy and coordinate resources and take necessary measures to solve the problem in time to protect the safety and interests of employees and stakeholders. Crisis communication and public relations should also not be neglected. Companies should actively communicate with all parties, provide timely and accurate information, respond to concerns and questions, and maintain the company's reputation and image. Establishing good communication channels and PR strategies can increase the public's understanding and support for the company. Finally, post-crisis evaluation and improvement is also an important part. Enterprises should conduct timely crisis review and evaluation, summarize lessons learned, and identify directions and measures for improvement to enhance crisis response capabilities and prevent future crises.

The first step in crisis response is the early detection of signs and alerts of a crisis. Companies need to have an effective crisis early warning system in place to monitor changes in the internal and external environment and potential risks. This can include regular risk assessments, market research, public opinion monitoring, competitor analysis, etc. With timely access to key information, companies can anticipate and identify potential crises earlier and take appropriate preventive and preparatory measures. In order to effectively manage a crisis, companies need to organize a crisis management team consisting of professional members from different departments to ensure comprehensive access to information and more efficient crisis management. The crisis management team needs to designate a crisis management plan that outlines strategies and procedures for crisis management and action plans. When assigning a crisis management plan, the crisis management team should consider as many different crisis scenarios as possible and prepare appropriate solutions.

Crisis communication should include regular updates and feedback, as well as effective opinion management. Through proactive communication and PR, companies can mitigate negative impacts, maintain their reputation and build public trust and support. The process of crisis response and reaction does not end with the resolution of the crisis. Companies need to conduct a post-crisis evaluation to review and conclude the effectiveness of crisis management. Through analysis and evaluation, companies can identify

opportunities for improvement and take steps to improve their crisis response and reaction capabilities. This continuous improvement and learning will help companies to be better prepared for future crises.

The improvement of crisis response and reaction capabilities is critical to a company's success in a crisis, and the relationship is shown in **Figure 6**.
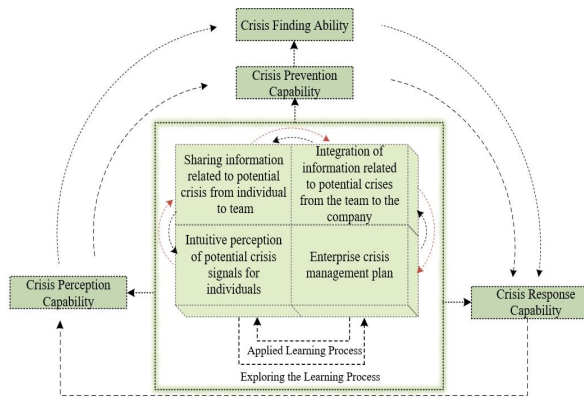

Figure 6. Improved Crisis Response and Reaction Capabilities

Maintenance of Brand Reputation and Public Trust

Maintaining brand reputation and public trust plays a critical role in corporate crisis information management. A company's brand reputation and public trust are the cornerstones of its long-term success and sustainability. Effectively maintaining brand reputation and public trust in the crisis management process is critical to reducing negative impact, restoring confidence and maintaining business continuity.

I. The Importance of Brand Reputation

Brand reputation is the image and reputation of an enterprise in the public's mind, and it is the consumer's perception and evaluation of the enterprise's products, services and overall value. A company with a good brand reputation will bring consumer loyalty, word-of-mouth communication and competitive advantages in the market.. In crisis management, a company's brand reputation can be severely tested and crisis events may negatively impact the brand image and reputation. Therefore, maintaining brand reputation is one of the important objectives of corporate crisis management.

Ⅱ. The Importance of Public Trust

Public trust refers to the degree of public confidence in a company, which mainly includes the evaluation of the company's integrity, ethics and social responsibility. To build public trust, companies need to actively take social responsibility. This means that companies need to fulfill their commitments, provide truthful and accurate information, and actively engage in social and environmental issues. By building and maintaining public trust, companies can win consumer support and loyalty, gain a competitive advantage and achieve sustainable development. Restoring public trust is critical for companies in crisis management, which

requires acting transparently and responsibly, responding positively to public concerns, and establishing positive communication channels to restore confidence and build sustainable relationships. In crisis management, restoring public trust is crucial for companies to rebuild their reputation and resume normal business operations.

III. Strategies to Maintain Brand Reputation and Public Trust

a. Crisis Prevention and Risk Management: Effective crisis prevention and risk management is the foundation for maintaining brand reputation and public trust. Companies should identify potential crisis risks and take appropriate preventive measures. This includes establishing a sound quality management system, monitoring market dynamics and setting up emergency response mechanisms.

b. Rapid Response and Crisis Communication: In the event of a crisis, companies need to respond quickly and communicate effectively about the crisis. Rapid response and timely communication can mitigate the impact of a crisis and build the enterprise's sense of responsibility and responsiveness.Businesses should ensure that accurate, transparent and honest information is provided in a timely manner to avoid the spread of rumors and untrue hearsay.

c. Responsible Behavior and Ethical Guidelines: Companies should comply with business ethics and industry guidelines to build and maintain public trust in the company. This includes fulfilling commitments, protecting consumer rights, protecting the environment, and supporting social welfare. Businesses should ensure that their actions and decisions meet social and ethical standards and demonstrate their commitment to social responsibility.

d. Transparency and Accountability: Transparency is an important factor in building public trust. Companies should ensure transparency of information and disclose crisis-related information and data. In addition, establishing a sound accountability system is key to maintaining public trust. Companies should take responsibility for crisis events, take appropriate measures to correct and improve them, and accept external monitoring and evaluation.

IV. Challenges of Transparency and Public Engagement

Companies may face a number of challenges when it comes to maintaining brand reputation and public trust. Transparency in information may require companies to disclose some information related to corporate crises; however, full transparency is not possible when designed for trade secrets.

EARLY WARNING RESEARCH ON CORPORATE CRISIS INFORMATION MANAGEMENT

Early warning for enterprise crisis information management refers to the monitoring and analysis of various risks and crisis factors to identify and warn of potential crisis situations in a timely manner so that enterprises can take appropriate measures to respond and manage them. Early warning models play a key role in enterprise crisis

information management and can help enterprises identify potential crisis risks in advance, reduce losses and protect their interests.

Analysis of the Elements of an Early Warning Model

for Enterprise Crisis Information Management

The following elements need to be considered in the construction of an early warning system for enterprise crisis information management (**Table 2**).

Table 2. Elements of Early Warning Model Construction

Features	Details
Data Collection and Monitoring	An early warning system needs to collect and monitor a variety of data and information related to a corporate crisis, including market dynamics, competitor behaviour, consumer feedback, public opinion, etc. These data can be obtained through internal and external channels, and analysed and evaluated.
Risk Assessment and Analysis	Early warning systems need to conduct risk assessment and analysis of the data collected to identify potential crisis risks and threats. This can be done using various analytical tools and methods such as statistical analysis, data mining, risk assessment models, etc.
Early Warning Indicators and Threshold Settings	Early warning systems need to establish a set of effective early warning indicators and threshold settings in order to detect and judge crisis situations in a timely manner. These indicators and thresholds can be customised and set according to the specific needs of the enterprise and industry characteristics.
Early Warning Signals and Alert Mechanisms	Once an early warning system detects a potential crisis situation, it should be able to generate appropriate early warning signals and alert mechanisms. This can be done through automated system notifications, alarms, emails, etc. and ensure that relevant information is available to relevant personnel in a timely manner.
Decision Support and Crisis Response	The early warning system should also provide appropriate decision support and crisis response advice. It can provide management with relevant information and advice based on the data collected and analysed to help them make informed decisions and take appropriate action.

Enterprise Crisis Information Management Early Warning Model Construction

The context in which the early warning model for corporate crisis information management is built is driven by the complex and uncertain business environment faced by modern enterprises. In the era of globalization, fierce competition and information explosion, enterprises are faced with various risks and crises, which may lead to serious economic losses received by enterprises and even threaten their survival and development.

In the past, companies usually took emergency measures only after a crisis occurred, which made them receive more losses and at the same time, crisis management was inefficient. More and more companies are realizing the need to establish an early warning mechanism. Early warning mechanisms can identify and predict potential crises in advance, facilitating timely response measures to minimize losses and protect the interests of the enterprise.

With the development of contemporary information technology and data science, enterprises can use advanced technologies such as big data, artificial intelligence and machine learning to build early warning models for crisis information management. These models can identify potential crisis signals and risk factors through data collection and analysis based on internal and external data sources of the enterprise. Early warning models are constructed in the context of providing a scientific, accurate and real-time early warning mechanism to help companies take preventive measures to reduce the impact and loss of a

crisis before it occurs.

In addition, crisis events on a global scale, such as financial crises, natural disasters and public health crises, have further driven the need for early warning models for crisis information management in businesses. The outbreak and reach of these events are often unpredictable, so companies need to identify risks more acutely and quickly in order to respond appropriately before a crisis occurs.

Based on theories related to information management, the basic framework of a big data-based enterprise crisis information management early warning model is constructed by analysing each element (**Figure 7**). This section aims at the effective operation of the enterprise crisis information management early warning model and organically combines the environmental layer, user layer, data layer and application layer. The environment layer includes elements such as system, law, policy, and technology. The user layer is the enterprise. The data layer includes data collection, data pre-processing, data processing, data analysis, storage database and other aspects. The application layer includes database support, clarifying the meaning of warning, finding the source of warning, analyzing the warning signs, forecasting the warning level, formulating and releasing the warning plan, and analyzing and feeding back the warning results. These three layers, user layer, data layer and application layer, are closely connected under the influence of environment layer.
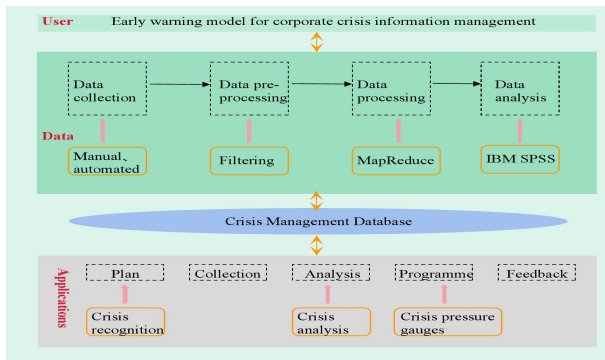
Figure 7. The Basic Framework of an Early Warning Model

Pre-processing of the collected data can effectively improve the accuracy of the collected data and at the same time increase the efficiency of the alerting process. Data pre-processing can be achieved through text filtering, data filtering, etc. Data pre-processing can be performed by personnel manually eliminating useless information and also by using excel, FinBI and other software for data pre-processing statistics. At the same time data pre-processing, the operator can also want to centralize the data summary. If the user enters into the aggregated data the data requirement criteria related to the enterprise crisis information management early warning model, the computer performs data screening and text filtering. If the data does not meet the requirements of the enterprise crisis information management early warning model, this data is rejected. If the data meets the requirements of the enterprise crisis information management early warning model, the data will be processed for the next data processing operation(**Figure 8**).
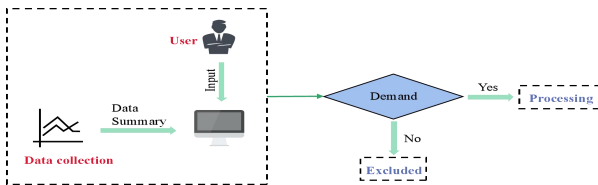
In the process of data pre-processing, it is necessary to carefully consider the potential connection between data, and it is possible to combine two or more kinds of data that are not connected with each other to discover the potential value of them. In the process of data pre-processing, it is important to keep in mind the principle of preferring more to

Figure 8. Data Pre-processing

less, and not to arbitrarily eliminate useless information, while the retained data should also be based on something.

By overlaying crisis impact values with the probability of a potential crisis in the same coordinate system, a crisis pressure table model can be constructed (**Figure 9**).
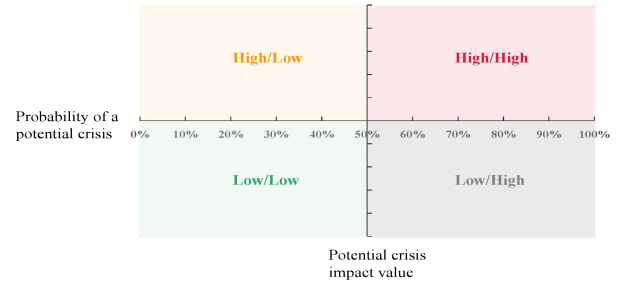

Figure 9. Corporate Crisis Stress Gauge

Analysis of **Figure 9** shows the probability of a crisis occurring and the value of the impact of the crisis on the enterprise according to the crisis pressure gauge model, and determines the specific situation of the enterprise at this time. When the enterprise crisis is in the red zone (high probability of crisis occurrence and high impact of crisis on the enterprise), it is necessary to immediately carry out crisis warning, quickly develop crisis solutions and adjust flexibly until the crisis is solved. When the crisis is in the yellow zone (low probability of crisis, crisis impact on the enterprise), this time the enterprise should pay attention to the real-time changes in the crisis, in order to change the crisis occurred when the rapid response. When the crisis is in the green zone (the probability of crisis is low and the impact of crisis on the enterprise is small), the enterprise can operate without worrying and pay moderate attention to the crisis situation of the enterprise. When the crisis is in the gray zone (high probability of crisis, crisis impact on the enterprise is small), enterprises need to be vigilant at all times to avoid unnecessary losses caused by the crisis to the enterprise.

Case Study of Early Warning Model for Enterprise Crisis Information Management

In order to verify the data pre-processing performance and information filtering performance of this early warning model, 600 web pages are selected as test data; 200 web pages are selected for one test, and a total of three tests are carried out; the test results are shown in **Table 3**.

Table 3. Early Warning System Enterprise Stress Indicator Test Results

Case	Expected Output	Early Warning Model Output
Yueyue Medical Oximeter Price Increase Controversy	Yellow	Yellow
Blue Bunny Stamp Controversy	Green	Green
Aiqiye Membership Rights Controversy	Yellow	Yellow
NetEase Blizzard Termination of Cooperation Incident	Red	Red
Public Opinion Controversy of the Movie Man Jiang Hong	Green	Yellow

As can be seen from **Table 3**, the accuracy of the enterprise crisis information early warning model can reach 80% of the enterprise crisis pressure table indicators, except in the enterprise crisis case of "Movie "Man Jiang Hong" Public Opinion Controversy" where the output pressure indicators of the early warning model are higher than the expected indicators, the other enterprise cases can be well evaluated by the pressure indicators of the enterprise crisis.

CONCLUSION

This paper firstly introduces the crisis management, analyzes the importance and key elements of information management under enterprise crisis; and proposes the early warning model of enterprise crisis information management based on the relevant theory of data analysis, and obtains the enterprise crisis pressure index.

The article uses enterprise crisis cases to verify the accuracy of the data preprocessing part of the early warning model and enterprise crisis pressure indicators, and the test results show that the enterprise crisis information management early warning model and enterprise crisis pressure table indicators proposed in this paper have better early warning effect, in which the accuracy of the enterprise crisis pressure indicators can reach 80%; the enterprise crisis information management early warning model proposed in this paper can see the possibility of the occurrence of the crisis and the crisis to the enterprise subjectively; it can also analyze the information management of the enterprise under the crisis, and analyze the key elements of the crisis. The enterprise crisis information management early warning model proposed in this paper can subjectively see the possibility of the occurrence of enterprise crisis and the impact value of the crisis on the enterprise, so that the enterprise can take corresponding measures to cope with the enterprise crisis.

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