Public Knowledge Management for Public Safety (Postprint)

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Abstract

[Purpose/Significance] Using the COVID-19 pandemic as a breakthrough point, this study remedies the deficiency of the library and information science (LIS) field in public knowledge management and conducts knowledge management research for emergency management of public safety emergencies. [Method/Process] Through analysis and comparison of domestic and international theoretical and practical communities, a public knowledge management development model suitable for China is derived. [Results/Conclusion] Research on public knowledge management oriented toward public safety can reduce the occurrence frequency of public safety emergencies and protect disaster-bearing entities.

Full Text

Preamble

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Public Knowledge Management for Public Safety

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Abstract

[Purpose/Significance] Taking the COVID-19 pandemic as a breakthrough point, this study aims to address the gap in public knowledge management within the library and information science field and advance knowledge management research for public safety emergency management.

[**Method/Process**] Through comparative analysis of theoretical and practical developments both domestically and internationally, a development model of public knowledge management suitable for China's context is derived.
[**Result/Conclusion**] Research on public knowledge management for public safety can reduce the frequency of public safety emergencies and protect disaster-bearing entities.

Keywords: public knowledge management; public safety; emergency; emergency management
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Since the 1990s, both theoretical and practical circles of knowledge management have predominantly focused on enterprises, to the extent that enterprise knowledge management became virtually synonymous with knowledge management itself. Although the scope of knowledge management has since expanded beyond enterprises to encompass other organizations and individuals—giving rise to domains such as personal knowledge management, government knowledge management, media knowledge management, library knowledge management, and archives knowledge management—these areas have received comparatively less attention than their corporate counterpart. In particular, public knowledge management has lagged behind personal and organizational knowledge management in its development, making it imperative to strengthen public knowledge management initiatives.

1 Three Types of Knowledge Management

Knowledge management has evolved alongside the development of the knowledge economy, treating knowledge as both capital and a management element that acts upon organizations, individuals, and society, thereby driving a management revolution and elevating value theory from information to knowledge. With knowledge as its primary element, knowledge management—after achieving success in enterprise applications—has continuously developed theoretically and expanded its application scope, gradually forming three distinct types of knowledge management. Public knowledge management concerns the management of public knowledge resources, involving knowledge management applications in social public service departments, public welfare institutions, scientific and cultural education departments, press and publishing sectors, and radio and television broadcasting.

1.1 First Type: Organizational Knowledge Management

Early knowledge management was positioned within the "enterprise" domain. Grounded in enterprise knowledge theory, it emerged and gradually developed

as a novel enterprise theory through the exploration of the roots of corporate competitive advantage and the critique of mainstream enterprise theories. In terms of content, enterprise knowledge management represents enterprise management with knowledge as its object—a continuous management process of corporate knowledge to meet current and future organizational needs, identifying and utilizing existing or newly acquired knowledge capital to create new opportunities for the enterprise. In terms of purpose, enterprise knowledge management enhances organizational adaptability, innovation capacity (including technological, organizational, and management innovation), and sustainable development capabilities through knowledge sharing and the application of collective intelligence. After mature theories and methods of knowledge management were established for profit-oriented enterprises, they were applied to non-profit organizations such as libraries, media outlets, and schools, where their effectiveness has been demonstrated.

1.2 Second Type: Personal Knowledge Management

After the first type of knowledge management reached certain breadth and depth, researchers realized that the collective intelligence emphasized by knowledge management could not be separated from individual contributions. Without personal knowledge management, organizational knowledge management would be difficult to elevate. In early research literature, F. Jason and H. Carol identified information explosion and rapid development of information technology as the primary drivers of personal knowledge management [1]. Personal knowledge management is the process by which individuals manage knowledge, dealing with encoded knowledge (explicit knowledge), embodied knowledge (tacit knowledge), and codified knowledge [2]. It helps individuals collect and organize information, making it structured and systematic, so that existing information can help individuals achieve goals or create new knowledge.

1.3 Third Type: Public Knowledge Management

As organizational and personal knowledge management developed, knowledge management further expanded to society, giving rise to the third type: public knowledge management. Public knowledge management involves the management of public knowledge resources, encompassing applications in social public service departments, public welfare institutions, scientific and cultural education departments, press and publishing sectors, and radio and television broadcasting. Related government knowledge management [3] originated from records of various organizational activities within government, aiming to document past work conditions and existing problems for memoranda, reference, and guidance for present and future work. After the 1990s, with the rapid development of the Internet, government management also underwent a transformation from e-government and information government to knowledge-based government.

2 Research on Public Safety Emergencies from a Public Knowledge Perspective

The aforementioned first type of knowledge management represents research from an organizational knowledge perspective, the second type from a personal knowledge perspective—both of which have been extensively studied. The third type, from a public knowledge perspective, can be applied to research on public safety emergency issues.

2.1 Theoretical Basis for Public Safety Emergency Research

Internationally, emergency management is referred to as public safety management. In the 1970s, the U.S. National Governors Association proposed the Emergency Lifecycle theory, dividing public safety emergencies into four life stages (see Figure 1 [Figure 1: see original paper]): Mitigation, Preparedness, Response, and Recovery [4]. Taking the COVID-19 pandemic as an example, the Mitigation stage involves the formulation of relevant policies and laws before the outbreak, including public information legislation to reduce the probability of occurrence. The Preparedness stage refers to the initial period when an outbreak may occur (when cases are confirmed but have not yet spread widely), during which emergency plans should be prepared, special resources provided, and emergency drills conducted. The Response stage involves implementing contingency plans, issuing warnings, mobilizing resources, providing medical assistance and emergency relief, and city lockdowns after the outbreak. The Recovery stage involves reconstruction, including rebuilding medical resources, resuming production, and psychological rehabilitation for affected populations. Canada fully adopted the U.S. four-stage lifecycle theory, supplementing the Mitigation stage as Prevention/Mitigation to form the PPRR four-stage model. In 1986, Steven Fink constructed a four-stage model from a medical perspective, corresponding to different stages of disease development: Prodromal, Breakout, Chronic, and Resolution. Crisis lifecycle theory was initially proposed for corporate crises and later frequently applied to public safety emergency management.

In China, Academician Fan Weicheng, Director of the Institute of Public Safety Research at Tsinghua University, established a triangular theoretical model for public safety (see Figure 2 [Figure 2: see original paper]) [5]. This theory divides public safety into three dimensions: emergency events, disaster-bearing entities, and emergency management. Objective substances such as matter, energy, and information are called disaster elements, but when these elements exceed environmental capacity in a short period, they form emergencies. Disaster-bearing entities are objects whose bodies are damaged or functions lost during emergencies—the very objects that public safety knowledge management aims to protect. In this COVID-19 pandemic, disaster-bearing entities include people (illness, death), objects (loss of function of the Huanan Seafood Market), and systems (city lockdowns). Different emergencies produce different damages to disaster-bearing entities: earthquakes destroy bridges, surfaces, and ecosystems, while rumors cause social panic. Emergency management aims to reduce the

frequency of emergency events or protect disaster-bearing entities. Therefore, we need to conduct knowledge management of past similar emergencies, artificially intervene in the occurrence and development of emergencies, improve the resilience of disaster-bearing entities, and maximize the protection of national, social, and public lives and property.

2.2 Four Major Research Areas of Public Safety Emergencies in China

Under the extraordinary circumstances of the pandemic, academia has conducted extensive research on public safety emergencies. Current research on public safety emergencies is mainly divided into four major areas: (1) The safety and management domain, including safety science, disaster science, emergency management theory, crisis management theory, and collaborative management theory—essentially the joint concern and research of safety science and management science regarding public safety emergencies; (2) The social and political domain, primarily including sociology (especially risk sociology), policy science, and law; (3) The information and technology domain, corresponding to information science and technology science; and (4) Psychology and other sciences, with psychological science providing significant support for theoretical research on public safety emergencies. At present, various disciplines across the entire knowledge domain have made outstanding contributions to research on this pandemic and public safety emergencies in general.

A CiteSpace-based study found that China's academic landscape of public safety and emergency management research includes seven major aspects: concepts and classification of emergencies, construction of emergency management systems and mechanisms, government responsibilities and roles in public safety governance and emergency management, exploration of public safety governance theoretical systems, development and preparation of emergency management industries, public health governance, and crisis prevention and control [6]. Research on these seven aspects generates vast amounts of data and information. Knowledge management needs to process complex data and information endowed with certain meanings into structured, valuable knowledge, reducing the probability of similar public safety emergencies and protecting disaster-bearing entities.

2.3 Information Perspective vs. Knowledge Perspective in Public Safety Emergency Research

Since 2000, China has experienced three major public health emergencies (see Table 1). Traditional lists and knowledge graphs can only perform simple data analysis, which no longer meets the complexities of current public safety emergencies. Many problems that cannot be solved through information analysis urgently require discussion from a knowledge perspective. This pandemic's global reach and unprecedented number of cases and deaths highlight these limitations.

As shown in Table 1, all three outbreaks since 2003 occurred during the Spring Festival period. Research on the correlation between timing and pandemic knowledge can combine epidemiological and knowledge management perspectives to provide reference for studying the causes and processes of pandemic outbreaks. Through knowledge management, we can distinguish between patterns and contingent factors in public safety emergencies and provide conclusions to experts in other fields for further research.

Building on the above analysis of public safety emergencies, we further identify significant differences between the information perspective and knowledge perspective (see Table 2).

Table 2. Information Perspective vs. Knowledge Perspective in Public Safety Emergency Research

Aspect	Information Perspective	Knowledge Perspective
Analysis Object	Event itself	Establishing systematic mapping of relationships between events
Analysis Process	Data-to-information conversion (shallow information flow)	Information-to-knowledge conversion (knowledge flow from analyzing ordered/unordered information)
Analysis Dimension	Linear, codable factors	Linear and non-linear, codable and non-codable information processing
Analysis Methods	Computer-based and specific technical methods	Knowledge graphs, human cognition, and more abstract methods
Analysis Depth	Focus on points, lines, and surfaces	Emphasizes three-dimensional perspective
Analysis Results	Direct, intuitive, and superficial	Explores essence behind appearances—both direct and indirect
Decision-Making Role	Assists or supports decision-making	Participates in decision-making and enables scientific prediction

As demonstrated in Table 2, the information perspective focuses on events themselves, while the knowledge perspective aims to establish systematic mappings of relationships between events. In terms of analysis process, the information perspective deals with shallow information flows from data to information, whereas the knowledge perspective transforms information into knowledge by analyzing ordered or unordered information flows to obtain knowledge flows. Regarding

analysis dimensions, the information perspective considers only linear, codable factors, while the knowledge perspective addresses both linear and non-linear, codable and non-codable information processing. In terms of analytical methods, the information perspective employs computer-based and specific technical methods, while the knowledge perspective utilizes knowledge graphs, human cognition, and more abstract approaches. Regarding analysis depth, the information perspective focuses on points, lines, and surfaces, while the knowledge perspective emphasizes three-dimensional understanding. In terms of results, information perspective research is direct, intuitive, and superficial, whereas knowledge perspective research explores the essence behind appearances, being both direct and indirect. Finally, regarding decision-making roles, information perspective research can only assist or support decision-making, while knowledge perspective research can directly participate in decision-making and enable scientific predictions.

3 Strengthening the Theory and Application of Public Safety Knowledge

Since American scholar Horton proposed the "lifecycle of facts," the development path from data to knowledge has been widely discussed and various theoretical models have been formed. Drawing on the knowledge pyramid model, the author establishes a public safety pyramid model (see Figure 3 [Figure 3: see original paper]), where public safety big data forms the base layer, and the ultimate destination of big data is "knowledge" or a "knowledge base."

Public safety information is meaningful data. Along with big data, its importance is self-evident. Their common characteristics include: easily obtainable sources, codable and clear processing, and relatively simple dissemination. In contrast, due to the existence of tacit knowledge, public safety knowledge relies more heavily on human judgment and learning, making it difficult to acquire, complex to process, and challenging to transfer.

Public safety knowledge is based on data and information, requiring the formation of knowledge collections and theoretical models through practice. Taking the U.S. public safety emergency command system as an example (see Figure 4 [Figure 4: see original paper]) [7], under the chief emergency commander, there are three horizontal coordinators, one specifically responsible for public safety information. In addition to these four responsible persons vertically, there are information and intelligence functions. Public safety knowledge plays a critical decision-making and control execution role throughout the entire command system.

National warning systems are also products of knowledge rather than mere information—they represent knowledge systems. Comparing Chinese and U.S. warning level colors (see Table 3), the U.S. has established a five-level national crisis warning system using red, orange, yellow, blue, and green to represent different danger levels and corresponding response measures. This knowledge

system directly influences U.S. public safety emergency management. China has also established its own public safety indicator knowledge system, dividing its public safety emergency warning system into four levels distinguished by red, orange, yellow, and blue colors. This is very similar to the U.S. five-level system but differs significantly in action implementation. Colors and classification levels are important elements of knowledge management, demonstrating that public knowledge management directly supports public safety decision-making and the entire emergency management process.

4.1 Dimension One: Knowledge Management for Public Undertakings

Although research on knowledge management for public departments is still in its infancy, it has achieved promising results. Public management involves social public undertakings and relates to public welfare information institutions such as scientific, cultural, and educational departments, press and publishing sectors, and radio and television broadcasting—all of which require knowledge management. Currently, aside from libraries and universities, other departments rarely have systematic knowledge management. Therefore, promoting knowledge management in public undertakings is both an inevitable requirement for knowledge sharing and innovation across society and an urgent direction for their own development efforts.

4.2 Dimension Two: Knowledge Management for Public Knowledge Resources

With the development of big data and blockchain theory and the deepening of human self-understanding, knowledge resources have become the third major resource type alongside material and energy resources. Knowledge resource management can describe all activities related to the management and utilization of social knowledge resources, further divided into intellectual property management, scientific research management, literature and information management, knowledge system management, and network knowledge resource management [8]—all falling within the scope of public knowledge resource management. This dimension deserves strengthened research attention.

Public knowledge resources constitute various forms of knowledge created by human society that, after certain processing and treatment, form a knowledge foundation and aggregation. In the book *Knowledge Science Research*, national knowledge capital is specifically introduced. Nick Bontis from McMaster University's DeGroote School of Business proposed a National Knowledge Capital model and index, where national wealth comprises financial wealth and knowledge capital, with the latter divided into human capital and structural capital [9]. This essentially transforms enterprise-level concepts of market value, financial capital, customer capital, and innovation capital into national-level concepts of national wealth, financial wealth, market capital, and renewal capital. National knowledge capital research must address public knowledge repositories, scientific knowledge management based on open scientific data (including man-

agement of outcomes from national social science funds, national natural science funds, and Ministry of Education funds), and government knowledge management based on open government data.

4.2.1 National Knowledge Capital The importance of knowledge for public safety and emergency management is increasingly prominent, and related research has gradually formed a knowledge system that plays a greater role than information. During the COVID-19 pandemic, pharmaceutical, safety, psychological, and other research institutions published numerous relevant research findings, which constitute part of the public health safety knowledge system we most lack—extending beyond the original scope of public knowledge to form a new category of public knowledge management.

4.2.2 Language and Terminology Management Language is a hallmark of human evolution and an important carrier of knowledge, connecting both parties in knowledge exchange and bearing various information, knowledge, and cultures. However, many languages in the world are on the verge of extinction, with fewer and fewer speakers of minority languages. The continuous disappearance of some languages directly threatens human cultural heritage and the inheritance and innovation of knowledge and culture. Language management should not only rely on linguists but also require the efforts of knowledge management experts. The library and information science community should establish language material knowledge repositories distinct from linguistic research, preserving various human language materials in digital and multimedia formats.

Terminology is the linguistic symbol referring to concepts within academic systems, the keywords condensing a discipline's knowledge system, and the crystallization of knowledge within a field. Terminology knowledge management mainly comprises two components: terminology theory research and terminology standardization construction. Theoretical research in terminology provides a theoretical foundation for terminology knowledge management and consolidates terminology's disciplinary status. Terminology standardization aims to eliminate language barriers in understanding and communicating various knowledge, ensuring effective knowledge sharing. The rapid development of terminology has made global knowledge sharing in all fields possible. To ensure timeliness in knowledge sharing, paper-based scientific terminology management can no longer meet the demands of the times, making the construction of online terminology databases an inevitable trend. Library and information professionals are obligated to ensure that national public academic resources are not lost and that knowledge sharing across all disciplines is effectively implemented.

4.2.3 Network Resource Knowledge Management Since humanity entered the network era, the speed and manner of knowledge dissemination have undergone qualitative changes. Network resource knowledge management involves managing all activities related to network knowledge resources. Managing information resources on networks has long been a focus of library and

information science. All information appearing on networks risks disappearing if not preserved, yet no global public network resource repository exists to save this information. Transforming effective information that has existed on networks into network knowledge is a direction that requires further effort from the library and information community.

4.3 Dimension Three: Knowledge Management for Public Safety

Public safety knowledge management has two major directions: regional public safety knowledge management and public safety emergency knowledge management. Regional public safety knowledge management concerns national security knowledge management and can also involve international security knowledge management, directly supporting national security decision-making and providing decision support for international security agencies. Public safety emergency knowledge management is critically important. China subdivides public safety emergencies into four major domains: natural disasters, accidental disasters, public health events, and social security events. The public safety emergency knowledge management process includes four stages: knowledge generation, knowledge acquisition, knowledge dissemination, and knowledge utilization surrounding public safety emergencies.

Taking the COVID-19 pandemic as an example, although the outbreak generated vast amounts of data, we still lack related knowledge. How can the public obtain epidemic prevention knowledge? Can they access this knowledge? Who should generate and disseminate this knowledge? How should this knowledge be applied? This pandemic particularly reveals the lack of knowledge management around these four aspects.

Using the "mask-wearing" issue as a case study: since the outbreak began, "wearing masks" has become an advanced experience in China's epidemic prevention, yet its international promotion has proven extremely difficult. This superficial observation reveals that the absence of knowledge management prevented the importance of "mask-wearing" from being accepted by the public. Some domestic and international mass media, particularly self-media, reported news of people in some countries not wearing masks and offered various analyses and criticisms, attributing the issue to political factors and public quality, remaining at the surface level. Analyzing from a public knowledge perspective, it is not difficult to find that cultural differences are the primary root cause behind this phenomenon. This demonstrates that behind the superficial information reported by media lie numerous knowledge issues that require exploration from a knowledge management perspective to uncover more essential roots.

Whether predictions derived from information are scientific should not rely solely on big data but must incorporate relevant knowledge from knowledge management. Whether the future is predictable remains undetermined, but this does not affect the application of knowledge management in the public safety domain. Public safety knowledge management aims to promote the generation,

acquisition, dissemination, and utilization of public safety-related knowledge, with primary service targets including governments, organizations, and individuals, particularly communities, media, and public security and fire departments. Comprehensive public safety knowledge management can establish complete systems and regulations, prepare special materials, maximize protection of disaster-bearing entities, and improve post-disaster reconstruction systems before public safety emergencies occur. Currently, we have the responsibility and obligation to explore the best paths and methodological guidance for public safety knowledge management on the foundation of public safety information management, contributing to the nation and its people.

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Author Contributions:
Ke Ping: Proposed the research proposition and framework; delivered conference presentations.
Hu Manman: Drafted the manuscript and conducted case analysis.

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Abstract: [Purpose/significance] Taking the COVID-19 pandemic as a breakthrough, to make up for the lack of public knowledge management in the field of LIS, and to do a good job in the knowledge management research of public safety emergency management. [Method/process] Through the analysis and comparison of theoretical and practical circles at home and abroad, a suitable development model of public knowledge management for China was obtained. [Result/conclusion] By studying public knowledge management for public safety,

the frequency of public safety emergencies can be reduced and the main body of disaster-bearers can be protected.

Keywords: public knowledge management; public safety; emergency; emergency management

Note: Figure translations are in progress. See original paper for figures.