Suggestions for the Application of Big Data Technology in Grid-based Community Management

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Abstract: Grid-based community management is a comprehensive approach to social governance that considers various elements, such as individuals, locations, objects, and events within the grid. By effectively addressing minor issues within the grids and tackling significant community-wide challenges, this model plays a vital role in resolving conflicts at the community level. However, to keep pace with the modernization of social governance, it is imperative to revamp and enhance grid-based community governance practices. This transformation necessitates the incorporation of advanced technologies like big data and artificial intelligence (AI) to break down information silos and implement more robust information security measures. Additionally, establishing a proficient team of grid managers is essential to ensure the smooth operation of this system. Furthermore, exploring the potential of AI, blockchain, and 5G applications in the realm of grid-based community management holds great promise for enhancing the efficiency and effectiveness of social governance initiatives. By leveraging big data and AI, the grid-based community management can gain valuable insights from the vast amounts of data generated within the community, enabling better decision-making and proactive problem-solving. Moreover, employing blockchain technology can enhance transparency and security in managing community records and transactions. The integration of 5G technology can facilitate real-time communication, enabling seamless connectivity and efficient management of grid-based communities. In conclusion, the application of big data, AI, blockchain, and 5G technologies in grid-based community management not only paves the way for improved social governance, but also contributes to the overall development and well-being of the community as a whole. Embracing these technological advancements is crucial in reshaping the landscape of community management and fostering sustainable development.

Keywords: Big Data Technology; Grid-based, Community Governance; Artificial Intelligence (AI); Efficient Decision-making

1. Introduction

The concept of grid-based urban community management has its roots in the pioneering efforts of Beijing's Dongcheng District in 2004. During this time, the district implemented a series of groundbreaking measures, notably the introduction of a 10,000-meter-unit grid management system and the implementation of urban event and facility management protocols. These innovative initiatives collectively formed the basis of what is now recognized as the new grid-based model for urban management in Dongcheng District. Following its inception, the grid-based management approach gained traction and was subsequently embraced and championed by government organizations across the nation. This widespread adoption underscores the efficacy and relevance of the Dongcheng model, positioning it as a noteworthy exemplar of innovative practices within the realm of public services undertaken by local governments. The Dongcheng District's trailblazing efforts have not only catalyzed a significant shift in urban management methodologies but have also spurred a nationwide reevaluation of best practices in governance and public administration. The district's model serves as a testament to the power of forward-thinking and adaptive strategies in addressing the complex

challenges inherent in urban development and community welfare. As a result, the impact of the Dongcheng model extends beyond its immediate geographical scope, influencing and inspiring similar endeavors in other regions and setting a precedent for effective, community-focused urban management practices nationwide.

Grid-based community management provides a comprehensive approach to social governance that takes full account of elements including people, places, objects, and events within the grid. This model resolves conflicts at the community level by addressing insignificant matters within the grids and solving major issues within the community. During the COVID-19 pandemic, grid-based management helped China establish a rigorous network for the prevention and control of infections at the community level. However, the model of grid-based community management ought to be transformed and upgraded, as China announces its goal of modernizing social governance. It requires the adoption of technologies such as the Internet, big data, and artificial intelligence to foster a more accurate and specialized model of grid-based community management.

2. Current Status and Challenges of Grid-based Community Management

Our investigation focusing on the application of big data technology in grid-based community management in Chongqing unveiled a number of challenges regarding the technology's adoption:

2.1 Difficulties in Sharing and Fusing Data and Eliminating Information Silos

At the moment, over 20 information platforms are employed for the grid-based management of communities in Chongqing. First, grid-based community management in Chongqing struggles with fragmented information and information silos between different departments. Community workers handle routine tasks, such as the collection and entry of data, dispatched vertically by relevant supervisory departments, public security, civil affairs, health, and other fields. The varying requirements of these departments mean that grid managers and community workers have to collect repetitive, non-shareable data and submit such data to different platforms.

Second, as a result of incompatible information systems and data structures of different departments, general data accepted in the front end cannot be coherently processed in the back end. The divide in information systems, the awkward flow of information due to inconsistent rules for data collection, transmission, and storage, and the passive intra-system acquisition of information all pose inconveniences for grid-based community management. Third, despite ongoing efforts to establish a community integration platform and thematic databases, technical challenges hinder effective information system sharing and integration. Third, it is highly challenging to share and integrate information for grid-based community management. Our research on the current state of grid-based community management in Chongqing revealed the city's ongoing efforts to set up a comprehensive community integration platform based on the fusion of users, data, and management. At the community level, Chongqing is developing its community governance repository and connecting it with the city's big data center. However, the sharing and integration of information across different systems has proved to be difficult, and more advanced technical support is required [1].

2.2 Potential Data and Security Breach

Digital grid-based community management involves the collection of residents' personal information, encompassing details such as names, social security data, medical records, and property specifics. This data is crucial for effective community administration and service provision. However, challenges arise in terms of data security and privacy protection within this framework. One significant issue pertains to the cybersecurity measures employed in systems facilitating digital grid-based community management. Insufficient safeguards in these systems can create vulnerabilities, potentially leading to data breaches and unauthorized access to sensitive information. Such breaches not only compromise individual privacy but also pose broader risks to community security and trust. Moreover, a critical aspect of data protection lies in the awareness and adherence of community workers to privacy protocols. In many cases, these personnel may not fully

grasp the importance of safeguarding citizens' personal information, inadvertently exposing them to the risks of data leakage and misuse. Strengthening training and awareness programs among community workers is essential to mitigate these risks and uphold data privacy standards. The integration of big data technology in community management, particularly highlighted by its role during the COVID-19 pandemic, brings both opportunities and challenges. While big data analytics offer valuable insights for decision-making and resource allocation, they also introduce new information security risks. The massive volume and diverse sources of data involved increase the complexity of data protection efforts, requiring robust security measures and proactive risk management strategies. In conclusion, addressing the data security and privacy concerns associated with digital grid-based community management necessitates a multi-faceted approach. This includes enhancing cybersecurity measures in systems, promoting privacy awareness among community workers, and implementing effective data governance practices to safeguard residents' personal information effectively. By proactively managing these challenges, communities can harness the benefits of digital technologies while ensuring the protection and privacy of individuals' data.

2.3 Untapped Potential of Digital Applications

Our on-site investigation uncovered that Chongqing's digital grid-based community management is still in its early stages, primarily depending on an information service platform constructed using Internet and big data technology. At present, the city has not fully delved into the widespread integration of advanced technologies like artificial intelligence, blockchain, and 5G communication within the framework of grid-based community management. This highlights the potential for leveraging these cutting-edge technologies to enhance the efficiency and sophistication of community management, propelling communities towards greater intelligence and interconnectivity.

2.4 An Inadequate Team of Grid Managers

First, Chongqing struggles with a shortage of qualified grid managers. According to field investigation, grid managers in some communities in Chongqing frequently resign from their jobs due to limited career prospects and low income, leading to a severe loss of qualified personnel. In certain communities, retired members are appointed as grid managers, but these senior citizens struggle with various mobile apps and information systems, rendering them ineffective in grid management tasks.

Second, most communities in Chongqing are not equipped with specialized personnel for the development and maintenance of smart platforms. Furthermore, the lack of mechanisms for the introduction, cultivation, and training of IT specialists has resulted in inadequate capabilities for fully leveraging certain smart terminals and application systems. This shortfall prevents communities from meeting the requirements of grid-based community management [2].

3. Measures and Suggestions for Grid-based Community Management

3.1 Eliminating Silos for the Smooth Sharing of Information

In grid-based community management, the existence of information silos results in inadequate information utilization, which, in turn, diminishes management efficiency and hinders accurate, specialized practices. Our suggestions for improvement in this regard include the following three aspects:

First, centralized coordination and government leadership ought to be reinforced in building a unified information service platform. At the moment, Chongqing has initiated the development of a city information model (CIM) platform. This will allow administrative data to efficiently converge with the city's big data center, thereby enabling more effective data utilization. Once the platform goes into service, existing information-sharing platforms across communities in Chongqing can be integrated into a unified information-sharing platform to resolve challenges in sharing information.

Second, communities should embrace centralized planning and implantation of information collection and adopt standardized specifications. Competent departments can formulate uniform standards for the collection, transmission, and storage of information, with the adoption of information systems and

databases that conform to the same standards. Chongqing is currently developing a data aggregation system with a "2+N" architecture. Here, "2" refers to shared systems and open systems, while "N" indicates the development of numerous data resource pools by government departments at the district/county level, numerous basic databases, and numerous theme-specific databases. This initiative aims to provide the resources for creating an integrated information-sharing platform.

Third, communities and systems should enhance their interactions and communications while pursuing mutual benefit and win-win results to understand each other's needs and provide convenience for one another, thereby fostering an open, accessible, and mutually beneficial framework for information sharing.

3.2 Adopting more Robust Measures to Mitigate Information Security Risks

First, the primary departments and individuals responsible for information security should be clarified. Those involved in the collection and transmission of information ought to assume the corresponding responsibilities. Specifically, the collectors of firsthand information, such as grid managers, communities, and government departments, should ensure the accuracy and authenticity of the information collected. Departments responsible for the storage and utilization of information must guarantee the security and reliability of the information stored or utilized. Technical support departments are required to ensure the security and operability of governance systems to prevent external attacks, information leaks, and malfunctions.

Second, efforts should be made to establish standards and regulations for information disclosure. Specifically, offices of legislative affairs of municipal people's governments can lead the formulation of guidelines for standardized government information disclosure to define the standards, scope, and specific content for information disclosure, with the addition of privacy information recognition and information reviews in the workflow of information disclosure.

Last but not least, regulatory duties must be fulfilled. Cyberspace administrations and public security departments ought to fulfill their regulatory responsibilities, urge departments to perform their security responsibilities in accordance with the law, and conduct regular investigations of information status concerning network nodes to prevent large-scale information security breaches.

3.3 Exploring Scenarios for Applying Artificial Intelligence, Blockchain, and 5G Technology in Grid-based Community Management

First, grid-based community management can benefit from the adoption of artificial intelligence on the basis of big data applications. For instance, AI applications such as license plate recognition and facial recognition can be employed for visitor management, allowing visitors can access residential quarters remotely through resident verification codes. AI-powered video surveillance can be used to address the issue of theft, a common crime in urban communities. In this scenario, AI can automatically detect and analyze the daily traffic flow and activities in a community and send alerts to community workers when suspicious individuals are identified, thereby making the community safer. In addition, AI can also be useful in other scenarios, including detection and prevention in communities and their surroundings, crowd analysis, and falling object detection.

Second, blockchain technology has much to offer in grid-based community management. Blockchains, which feature data immutability and distributed data storage, can be utilized to create a secure and shared information service platform to eliminate information barriers between departments, enabling efficient, secure data transmission. A model combining blockchain with community management, for example, can include residents, residents' committees, and subdistrict offices into the blockchain network to facilitate seamless communication between the stakeholders and improve governance efficiency.

Furthermore, 5G technology can be incorporated into grid-based community management. For instance, communities can employ 5G networks to set up high-speed, ultra-high-definition panoramic community information service platforms to achieve the rapid transmission and sharing of information.

3.4 Developing a Robust Team of Grid Managers

Training more competent grid managers is a key aspect of grid-based community management in the age of big data [3]. If an increase in the number of grid managers is not expected, the immediate goal in developing a robust team of grid managers should be to enhance the skills and competence of the existing workforce. Emphasis should be given to training and education, which involves providing grid managers with relevant skills and ideological training aligned with actual work requirements [4]. Moreover, grid managers should be trained to master digital technologies and tools. In this respect, one effective method is to regularly invite outstanding grid managers to offer lectures or share experiences, allowing their peers to learn from dialogues and embrace new perspectives. Such opportunities can also provide deeper insights into the crucial role of community grid managers and their work and help develop innovative work models catering to the realities (e.g., culture, traditions, resident population structure, etc.) of the specific community. On the other hand, efforts should be made to put into place a sound mechanism of incentives, supervision, and punishment for grid managers. This aligns the pace of recruitment/dismissal of grid managers with the actual needs of community governance, and a suitable system of performance-based layoff will also prove useful. The salaries of grid managers should be raised as appropriate to attract young professionals, especially those with expertise in both community governance and big data technology [5-6].

4. Conclusions

In conclusion, the application of big data, artificial intelligence (AI), blockchain, and 5G technologies in grid-based community management presents a transformative opportunity to enhance social governance and contribute to the overall development and well-being of communities. While the current status of grid-based community management faces challenges related to data sharing, security, technology adoption, and human resources, there are actionable measures and suggestions to address these issues. Efforts to eliminate information silos and enhance data sharing can be achieved through centralized coordination, standardized specifications, and improved interactions between communities and systems. Additionally, robust measures for mitigating information security risks involve clarifying responsibilities, establishing standards and regulations, and fulfilling regulatory duties. Furthermore, exploring the potential of AI, blockchain, and 5G applications in grid-based community management holds promise for enhancing efficiency and effectiveness. AI can empower communities with advanced surveillance, visitor management, and detection capabilities, while blockchain technology can facilitate secure and shared information exchange. Integration of 5G technology can enable rapid transmission and sharing of information within communities. Developing a proficient team of grid managers is essential, and it requires a focus on training, skills enhancement, and incentivizing young professionals with expertise in community governance and big data technology. Embracing these technological advancements is crucial in reshaping the landscape of community management and fostering sustainable development. By addressing the current challenges and leveraging advanced technologies, grid-based community management can evolve into a more efficient, secure, and proactive system, ultimately contributing to improved social governance and community well-being.

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