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ORIGINAL RESEARCH

A study on disruptive technologies toward smart cities governance

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Digital technology is employed to enhance decision-making, streamline service delivery, and optimize administrative processes within the government. Its purpose is to enhance the efficacy, efficiency, and transparency of governance. In smart cities, smart governance plays a vital role in augmenting the efficiency and effectiveness of municipal services while promoting transparency and citizen accountability. In our study, we have studied the disruptive technologies in smart cities governance from a theoretical standpoint. We have focused on the primary disruptive technologies utilized in the governance of smart cities—Blockchain, Artificial Intelligence, Internet of Things, Big Data, and 3D Printing—and we understand how each of these technologies is employed in the growth of smart cities. We also examined citizen awareness of the use and deployment of these technologies as part of our study. As part of our study, we also analyzed how aware citizens were of the use and deployment of these technologies. When compared with other applications of various technologies, our analysis finds that Big Data is the most extensively employed technology in the construction of smart cities. This article will come to the conclusion that these technologies have a substantial impact on the growth of smart cities and its governance.

Keywords: smart cities, smart governance, Blockchain, Artificial Intelligence (AI), Internet of Things (IoT), Big Data, 3D Printing

1. Introduction

Smart in smart cities refers to the effective utilization of technology to govern cities in a way that enhances efficiency, livability, and sustainability. It involves the active involvement of various stakeholders, including city officials, businesses, residents, and visitors. Technology can be leveraged in multiple ways to improve city governance. One key aspect is the use of data to facilitate informed decision-making. By analyzing trends, patterns, and performance indicators, data can guide city officials in improving services, upgrading infrastructure, and planning for future growth. Additionally, technology enables citizen engagement in decision-making processes. Online platforms provide opportunities for residents to contribute their opinions on city issues, while face-to-face interactions, such as community meetings and events, foster dialogue and collaboration. Social media platforms also serve as effective channels for disseminating information and updates on local news and events, facilitating communication between city authorities and residents. Moreover, technology can optimize city operations by gathering information through sensors and other equipment. For instance, data on traffic patterns and waste management can be collected, allowing municipal officials to improve service delivery and reduce costs. While technology is not a panacea for all urban challenges, when appropriately utilized, it can contribute to sustainable, livable, and efficient cities. In our study, we focused on the theoretical perspective of disruptive technologies in smart city governance. Specifically, we examined five key disruptive technologies: Blockchain, Artificial Intelligence (AI), Internet of Things (IoT), Big Data, and 3D Printing. We explored

how each of these technologies is applied to advance the development of smart cities. Additionally, we investigated citizens' awareness and understanding of the application and deployment of these technologies.

2. Review of literature

In a study conducted by Prasanna et al. (1), an innovative approach to smart traffic management using the IoT is presented. The researchers utilized the K-nearest neighbors algorithm to forecast traffic patterns, which were then communicated to users through an Android application on their smart devices. The system also incorporated a complex prediction mechanism with suggested alternative routes. To further enhance the system, the authors propose integrating cloud computing and installing display panels at key locations to provide real-time information on alternate routes with estimated time constraints. The work by Iyer and Giri (2) addresses the water-related challenges faced by Bengaluru, a rapidly expanding urban area with a significant migrant population. The research emphasizes the detrimental impact of irresponsible practices by builders, who have transformed lakes into real estate infrastructure. This conversion has resulted in issues such as blocked drains, excessive sewage, and frequent flooding. As a consequence of these challenges, there is now a considerable disparity between the demand for water and its supply in the region. Keshvardoost et al. (3) explored the governance models associated with smart city initiatives and shed light on the significant difficulties and problems faced by smart city governments. While the literature on smart cities is extensive, this study reveals a lack of governance models and structural variations in growth across different areas. The article emphasizes the need to address these gaps in order to effectively manage and govern smart cities. Mutiara et al. (4) undertook research aimed at assessing the compliance of public information disclosure legislation in the context of smart cities. The study focuses on evaluating government transparency and openness, providing insights into the effectiveness of public information disclosure laws and the overall performance of local governments in smart cities. Praharaj et al. (5) contributed to the discourse on urban governance in smart cities by presenting their unique theoretical conceptualizations supported by case studies. The research specifically examines the dynamics of urban governance in Indian cities that have embarked on ambitious initiatives to develop 100 smart cities. By analyzing these dynamics, the study offers valuable insights into the governance challenges and opportunities associated with such initiatives. Bharadwaj et al. (6) proposed an IoT-based architectural solution to address the challenges faced by current solid waste management systems. The authors advocate for the implementation of an IoT-based system that enables automated tracking, collection, and management of solid waste. This solution aims to enhance the efficiency and monitoring capabilities of solid waste management processes. In their study, Das et al. (7) explored the core components and concepts that underpin the concept of smart cities. The authors predict that, by 2030, all major cities worldwide will be on a trajectory toward becoming smart cities. In addition, existing smart cities will continue to evolve and embrace new technologies such as grid sensors and pneumatic waste disposal while incorporating sustainable architecture and low-carbon energy production practices.

3. Objective of the study

The objectives of this study are as follows:

(1) To study the theoretical background of smart governance in smart cities.
(2) To understand the disruptive technologies used in the governance of smart cities.
(3) To analyze the citizen awareness of the application of technologies in smart governance.

4. Disruptive technologies in smart cities governance and its public awareness

Disruptive technologies have the transformative potential to revolutionize the way smart cities are governed. These technologies offer numerous benefits, such as increasing accountability, transparency, and citizen engagement in decision-making processes. When applied to smart city governance, the following disruptive technologies have proven to be particularly advantageous:

Figure 1 shows the percentage of application of disruptive technologies in smart cities development in India which is based on available data from Smart Cities Mission authority, where usage and application of Blockchain is 1, AI is 16, IoT is 25, Big Data is 56, and 3D Printing is 2%.

4.1. Blockchain

Blockchain technology is a distributed database that revolutionizes how data are stored and controlled in smart cities. Its decentralized and secure nature offers numerous advantages for smart city governance. By utilizing Blockchain, transparency for residents can be enhanced, along with the effectiveness of city services. Blockchain's immutability and transparency can improve data management, asset management, and service provision in smart city governance. For instance, a decentralized register of city assets can be built using Blockchain, enabling

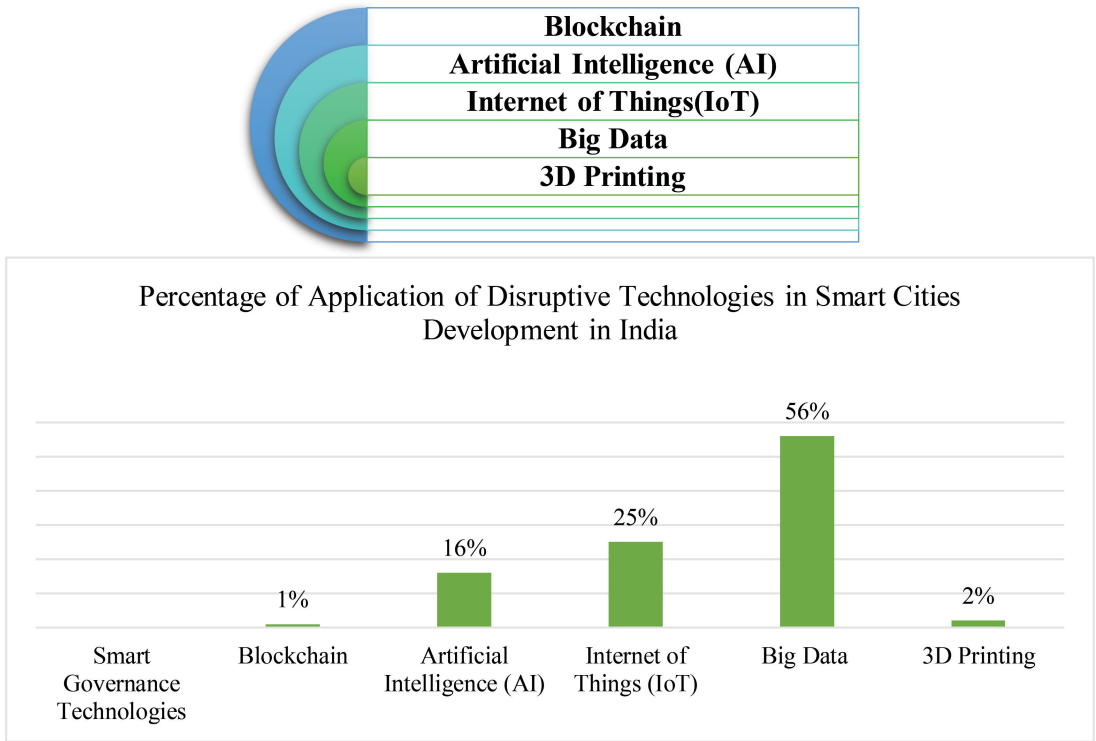

FIGURE 1 | Application of disruptive technologies in smart cities development in India. Source: https://smartnet.niua.org/learn/library.

more effective asset tracking and combating corruption. Additionally, Blockchain can facilitate the creation of a decentralized market for city services, improving efficiency and openness in service delivery.

4.1.1. Urban planning

Blockchain technology can be applied to urban planning in several ways. For example, Blockchain-based smart contracts can automatically enforce building codes and zoning rules. Blockchain can also be used to track the ownership of land parcels and structures, simplifying the identification of potential development locations. Moreover, marketplace applications built on Blockchain technology can enable the buying and selling of development rights, enhancing the efficiency of urban planning processes.

4.1.2. Universal ID cards

Blockchain can enhance the security and accuracy of national ID cards, preventing fraud and unauthorized access to personal information. By utilizing Blockchain technology, it becomes more challenging for thieves to acquire and misuse personal data, thereby reducing the risk of identity theft.

4.1.3. Land, property, and housing management

Blockchain technology simplifies and improves land, property, and housing management procedures. All relevant data can be securely and decentralized stored on the Blockchain, facilitating efficient tracking and administration. The transparency and immutability of Blockchain data also help reduce fraudulent activities in the sector.

4.1.4. Energy, water, and pollution management

Blockchain has the potential to transform the energy, water, and pollution management sectors. It can enable the creation of decentralized marketplaces for energy trading, reducing the need for a central authority. Blockchain can also facilitate the development of decentralized waste management systems, enhancing the tracking and management of waste. In the water sector, Blockchain can be used to establish decentralized water management systems, optimizing the utilization of water resources. Furthermore, Blockchain can contribute to the development of decentralized pollution management systems, improving the tracking and management of pollution.

4.1.5. Improving public transit

Blockchain can revolutionize public transit by creating a decentralized system that is not reliant on a single entity. This can lead to a more efficient, transparent, and cost-saving system, ultimately improving service quality. Additionally, Blockchain can enhance data tracking and management in public transit, aiding in better planning and operations.

4.1.6. Security for IoT devices:

Blockchain offers enhanced security for IoT devices through various mechanisms. It can store sensor data in a tamper-proof manner, ensuring data integrity. Blockchain can also

track the origin and authenticity of IoT devices, allowing for the use of trusted devices. Moreover, Blockchain can manage the identities of IoT devices, simplifying device tracking and control.

4.1.7. Departmental transparency:

Blockchain technology can increase transparency in government departments by providing a secure and transparent means of storing and sharing data. This facilitates easier tracking of government spending and enhances the accountability of government officials. Furthermore, Blockchain can be utilized to develop a secure and transparent voting system, encouraging public participation in government processes.

Figure 2 shows that there is a lack of information of about 54% of citizens in understanding the application of Blockchain technology in smart city governance and the rest of 46% tell that they have knowledge about Blockchain technology in different areas of application.

4.2. Artificial intelligence

Artificial Intelligence has the potential to assist city officials in making informed decisions, enhancing service delivery, and engaging citizens in decision-making processes. Its applications in city governance are diverse and include the following areas:

4.2.1. Automated monitoring and management of city infrastructure

Artificial Intelligence can play a vital role in the automated monitoring and management of city infrastructure. By leveraging AI, city officials can monitor traffic patterns, weather conditions, and energy usage. It can also facilitate the efficient management of infrastructure elements such as traffic lights, energy consumption, and maintenance needs. For instance, AI can analyze traffic patterns to predict congestion, identify infrastructure maintenance requirements, and manage construction projects. Additionally, AI can aid in the development of new smart city infrastructure, including smart buildings, bridges, roads, water and sewer systems, and transportation systems.

4.2.2 Planning and optimization of city resources

Artificial Intelligence can contribute to the planning and optimization of city resources through various approaches. It enables the creation of models that depict the utilization and interactions of city resources. These models can then be used to optimize resource usage, such as effective management of power and water resources, waste reduction, and congestion mitigation. AI can also support the creation and management of virtual city resources, including traffic lights or public transport timetables.

4.2.3. Traffic management and navigation

Artificial Intelligence is increasingly employed in traffic management and navigation systems. It assists in controlling traffic flow and optimizing navigation routes. By analyzing data and predicting traffic patterns, AI can suggest optimal routes to avoid congestion and improve travel efficiency. Furthermore, real-time traffic monitoring enables AI to identify issues and provide alternative routes in case of disruptions.

4.2.4. Crime prevention and detection

Artificial Intelligence can be a valuable tool in crime prevention and detection. Predictive analytics allows for the analysis of data to identify patterns and trends indicative of criminal activities. AI-powered facial recognition technology aids in identifying potential suspects. Additionally, AI-driven chatbots can engage in conversations with individuals contemplating criminal acts, aiming to dissuade them from committing crimes.

4.2.5. Emergency response and disaster management

Artificial Intelligence has significant implications for emergency response and disaster management. By analyzing extensive datasets, AI can identify patterns and trends that may indicate potential disasters. It can also monitor social media and online platforms to capture early warnings. Moreover, AI facilitates the coordination and management of emergency response efforts, improving the overall efficiency and effectiveness of disaster response.

By harnessing the potential of AI in these areas, cities can enhance their governance, improve services, and create more resilient and responsive urban environments.

Figure 3 shows that there is a lack of information of about 22% of citizens in understanding the application of AI technology in smart city governance and the rest of 78% tell that they have knowledge about AI technology in different areas of application.

4.3. Internet of things

The IoT holds tremendous potential for enhancing city infrastructure, improving service delivery, and increasing efficiency. By connecting devices and sensors, IoT enables data collection and process automation, leading to more informed decision-making and greater transparency for citizens. Here are key areas where IoT can make a significant impact:

4.3.1. Smart city governance

Internet of Things plays a crucial role in managing city resources and infrastructure. It enables the monitoring and management of essential systems such as water

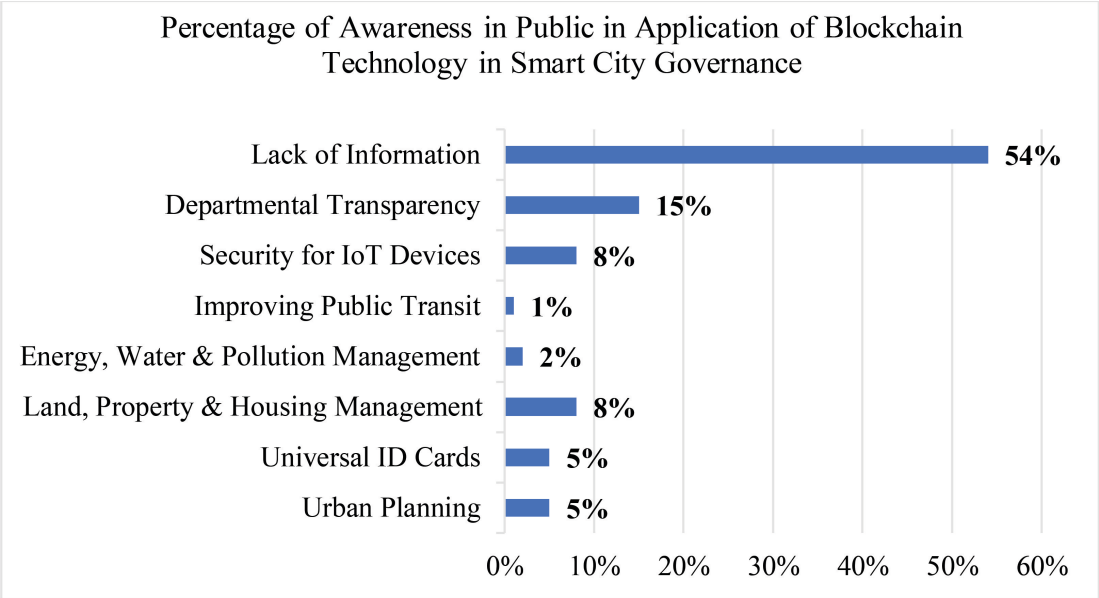

FIGURE 2 | Awareness of public on application of Blockchain technology in smart city governance.

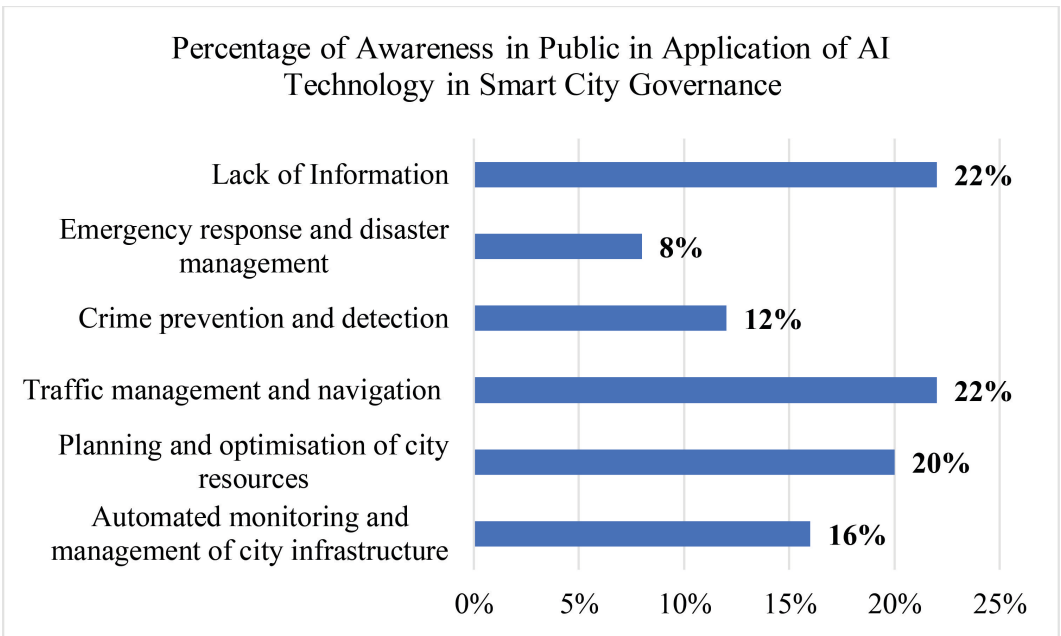

FIGURE 3 | Awareness of public on application of AI technology in smart city governance.

and energy networks, transportation systems, buildings, and public safety. IoT-driven insights and automation enhance resource allocation, maintenance planning, and operational efficiency.

4.3.2. Water-level monitoring

Internet of Things technology facilitates the development of water-level monitoring systems, allowing real-time monitoring of tanks or reservoirs. These systems send alerts to authorities when water levels drop below a specific threshold, enabling prompt action and emergency response.

4.3.3. Health monitoring

Incorporating IoT into health cards empowers patients to manage their well-being effectively. For instance, an IoT-enabled health card can monitor blood sugar levels, sending alerts to doctors in case of abnormal readings. Similarly, it can track medication compliance, vital signs, and physical activity and provide valuable insights for personalized care.

4.3.4 Waste and garbage management

Internet of Things, along with sensors, revolutionizes waste management by collecting data, tracking assets, and

optimizing operations. Smart garbage cans can detect when they require emptying, enabling efficient collection routes, reduced fuel consumption, and improved waste sorting capabilities. IoT integration also contributes to methane gas monitoring in landfills.

4.3.5. Smart transportation systems

Internet of Things optimizes transportation systems by tracking vehicles, managing traffic flow, and monitoring road conditions. This integration improves efficiency and safety and reduces accidents. Real-time traffic management systems using IoT facilitate congestion mitigation and enable authorities to respond swiftly to emergencies or accidents.

4.3.6. Surveillance systems

Internet of Things streamlines surveillance systems by centralizing device management and incorporating advanced features such as facial recognition and AI. This connectivity enhances efficiency, reduces costs, and enables more comprehensive monitoring and response capabilities.

4.3.7. Pollution control with sensors

Internet of Things-enabled sensors play a pivotal role in pollution control. They monitor air quality, water quality, and soil pollutants, issuing alerts when pollution levels exceed safe thresholds. This timely information empowers individuals and authorities to take necessary measures and mitigate environmental risks.

4.3.8. Smart energy management

Internet of Things optimizes energy generation, transmission, and consumption by monitoring energy consumption patterns, providing feedback for energy reduction, and facilitating demand-side management. Additionally, IoT ensures the safety and efficiency of energy infrastructure, monitors renewable energy sources' performance, and enhances overall energy sustainability.

4.3.9. e-Services

Internet of Things enhances e-services by enabling asset and inventory tracking, environmental monitoring, and real-time information delivery to customers. The data generated by IoT devices aid in improving operational efficiency and customer experience in various sectors.

By leveraging the power of IoT, cities can achieve greater sustainability, efficiency, and citizen-centric services, ushering in a new era of smart and connected urban environments.

Figure 4 shows that there is a lack of information of about 20% of citizens in understanding the application of IoT technology in smart city governance and the rest of 80% tell that they have knowledge about IoT technology in different areas of application.

4.4. Big data

Utilizing Big Data, cities can gain valuable insights into trends and patterns within their data, leading to improved service delivery and increased efficiency. By collecting and analyzing vast amounts of data from various sources, decision-making in urban planning, transportation, and public safety can be enhanced. Smart city governance involves using technology and data to improve city operations and services, with Big Data playing an increasingly crucial role in this process. It enables cities to make informed decisions regarding services, infrastructure, and economic development, as well as better understand and respond to residents' needs.

4.4.1. Smart transportation

Smart transportation systems leverage advanced technologies such as GPS, sensors, and connectivity to enhance transportation efficiency. The increasing demand for Big Data analytics in transportation systems drives market growth. Big Data analytics optimizes transportation by providing better visibility and management of infrastructure and operations. It analyzes vehicle data, transportation infrastructure data, and people data, enabling real-time decisions and predicting future traffic patterns to improve transportation systems and reduce costs.

4.4.2. Street surveillance

Municipalities are increasingly adopting Big Data analytics in street surveillance to enhance public safety. By analyzing large volumes of data captured by street cameras, law enforcement agencies can effectively identify and track criminal activity. This information allows for more efficient resource deployment and targeted patrols in specific areas.

4.4.3. Hospital management

Big Data is transforming hospital management systems, improving patient care and outcomes. Through tracking and analyzing substantial data, hospitals can identify patterns and trends to guide decision-making. For instance, Big Data helps monitor patient satisfaction, identify areas for improvement in care, and predict future service demands. Furthermore, Big Data enhances financial management and operational efficiency in hospitals.

4.4.4. Government departments

Big Data analytics holds significant potential for government departments. It enables the detection and prevention of crime, monitoring of terrorist activities, and efficient management of public resources. Law enforcement agencies utilize Big Data to identify crime patterns, predict potential crime locations and times, and track criminals and their associates. Government agencies can improve public service delivery by tracking resource utilization and identifying

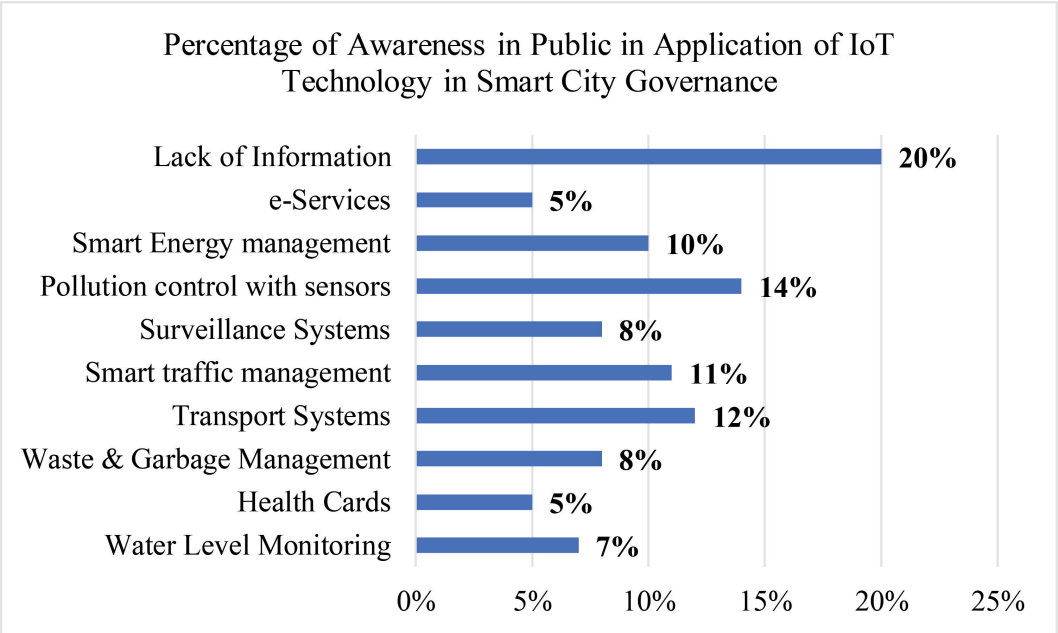

FIGURE 4 | Awareness of public on application of IoT technology in smart city governance.

areas for improvement, such as infrastructure enhancements. Additionally, Big Data enhances operational efficiency and streamlines processes within government agencies.

4.4.5. Fire detection

While still emerging, the use of Big Data in fire detection has transformative potential for emergency response. By analyzing extensive datasets, firefighters can accurately predict fire occurrences and their spread, enabling better preparedness and response. Big Data also helps identify patterns and trends in fire behavior, contributing to improved fire prevention and mitigation efforts.

4.4.6. Security surveillance

The increasing volume of video footage and data generated by security cameras necessitates effective management and analysis, leading to a rising demand for Big Data solutions in security surveillance. Big Data solutions enable organizations to handle and analyze these data efficiently, providing insights that enhance security measures.

Incorporating Big Data analytics into various sectors empowers cities and organizations to harness valuable insights, optimize operations, and enhance services. The ability to process and interpret large datasets enables data-driven decision-making and transformative improvements in multiple domains.

Figure 5 shows that there is a lack of information of about 15% of citizens in understanding the application of Big Data technology in smart city governance and the rest of 85% tell that they have knowledge about Big Data technology in different areas of application.

4.5. 3D Printing

The utilization of 3D Printing technology offers numerous benefits for city infrastructure and buildings, ultimately enhancing service delivery and increasing efficiency. By leveraging 3D Printing, cities can achieve customized and resource-efficient infrastructure solutions. This approach not only reduces construction costs and time but also promotes sustainability and environmentally-friendly practices. In the realm of smart city governance, 3D Printing technology plays a vital role. It enables the creation of detailed models for city infrastructure projects, allowing officials to gain a better understanding of the final outcomes. Moreover, 3D Printing facilitates the development of prototypes for new city products or services, enabling thorough testing before implementing them on a larger scale.

The medical field greatly benefits from 3D Printing as it enables the creation of prosthetic limbs, organs, and surgical planning models. The automotive industry utilizes 3D Printing to fabricate prototype parts and customized tools. In aerospace, the technology aids in the production of fuel nozzles and engine components. Additionally, 3D Printing finds application in the consumer electronics industry, where it creates cases and covers for devices. Furthermore, 3D Printing holds the potential to produce educational materials for city residents, offering valuable insights on various topics related to smart city governance. In the context of smart cities, 3D Printing technology extends its reach to the creation of infrastructure elements such as buildings, bridges, and other structures. Additionally, it facilitates the production of smart city devices like sensors, as well as customized products for residents, businesses, and visitors.

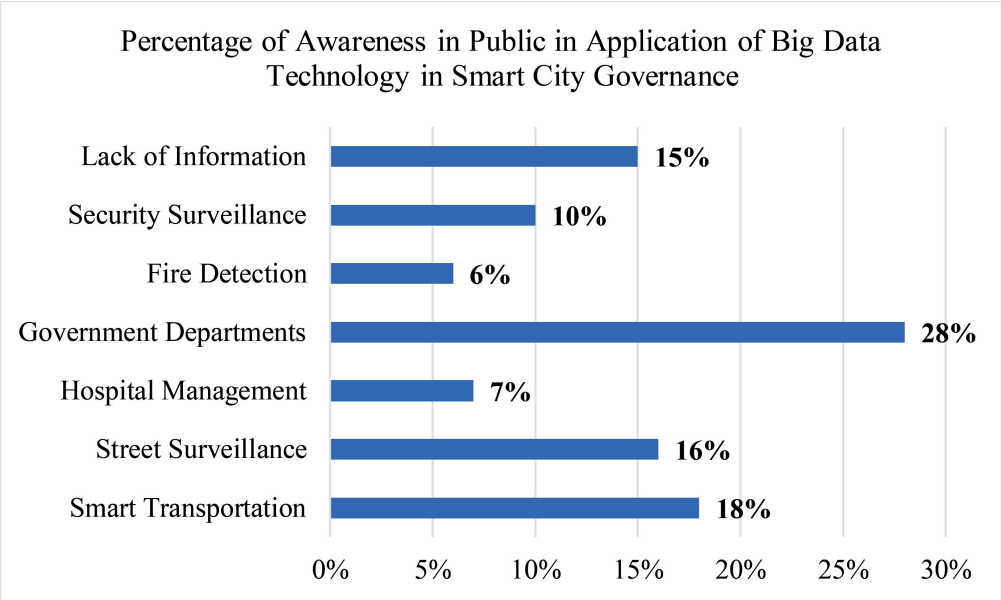

FIGURE 5 | Awareness of public on application of Big Data technology in smart city governance.

By embracing 3D Printing, cities can unlock new possibilities in construction, manufacturing, and innovation, fostering sustainable and efficient urban development.

Figure 6 shows that there is a lack of information of about 46% of citizens in understanding the application of 3D Printing technology in smart city governance and the rest of 54% tell that they have knowledge about 3D Printing technology in different areas of application.

5. Findings

The role of public awareness in the development and administration of smart cities varies depending on the city and project objectives. However, in general, public awareness is essential for the successful creation of smart cities as it ensures alignment between the initiative's goals and the needs and preferences of the city's residents. It also helps garner support for the project, which is crucial for securing financing and resources. This research specifically focuses on public awareness of disruptive technologies in smart city governance within Indian smart cities. Among the 150 respondents surveyed, it was found that Blockchain, AI, IoT, Big Data, and 3D Printing each have their own impact and application. This aligns with their understanding of these technologies in relation to smart city development.

5.1. Overview of awareness of public on application of disruptive technologies in smart city governance

Figure 7 shows that Blockchain has 46%, AI has 78%, IoT has 80%, Big Data has 85%, and 3D Printing has 54% of awareness of public on application of disruptive technologies in smart cities governance.

5.2. Overview of lack of awareness of public on application of disruptive technologies in smart city governance

Figure 8 shows that Blockchain has 54%, AI has 22%, IoT has 20%, Big Data has 15%, and 3D Printing has 46% lack of awareness of public on application of disruptive technologies in smart cities governance.

5.3. Overall average percentage of awareness of public on application of disruptive technologies in smart city governance

Figure 9 shows that the overall average percentage of awareness of public on application of disruptive technologies in smart city governance is 69%, and the overall average percentage of lack of awareness of public on application of disruptive technologies in smart city governance is 31%.

6. Suggestions

Education and Training Programs: Education and training programs should be developed and implemented to enhance public awareness and understanding of disruptive technologies in smart city governance. These programs

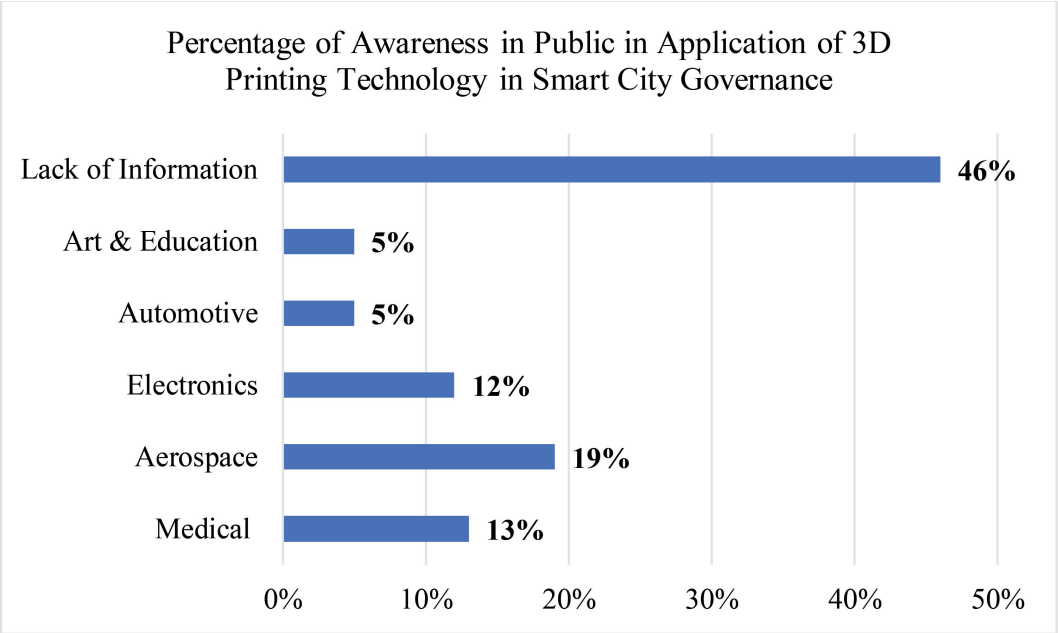

FIGURE 6 | Awareness of public on application of 3D Printing technology in smart city governance.

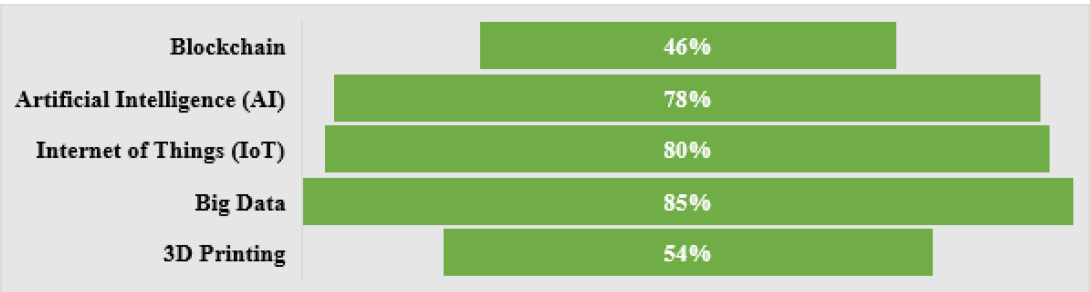

FIGURE 7 | Overview of awareness of public on application of disruptive technologies in smart city governance.

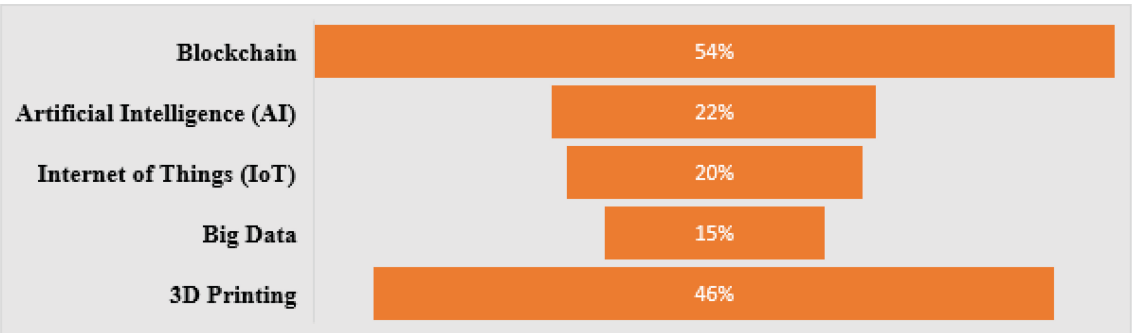

FIGURE 8 | Overview of lack of awareness of public on application of disruptive technologies in smart city governance.

can target various stakeholders, including citizens, government officials, and urban planners. Workshops, seminars, and online courses can be organized to provide information about the applications and benefits of disruptive technologies.

Public Engagement Campaigns: Public engagement campaigns should be launched to raise awareness about the potential of disruptive technologies in smart city governance. These campaigns can use various channels such as social media, websites, public events, and community gatherings to reach a wide audience. The focus should be on showcasing successful case studies and real-world examples of how disruptive technologies are improving governance in smart cities.

Collaboration with Industry and Academia: Collaboration between government agencies, industry experts, and

	% of Awareness	% of Lack of Awareness
Overall average percentage	69%	31%

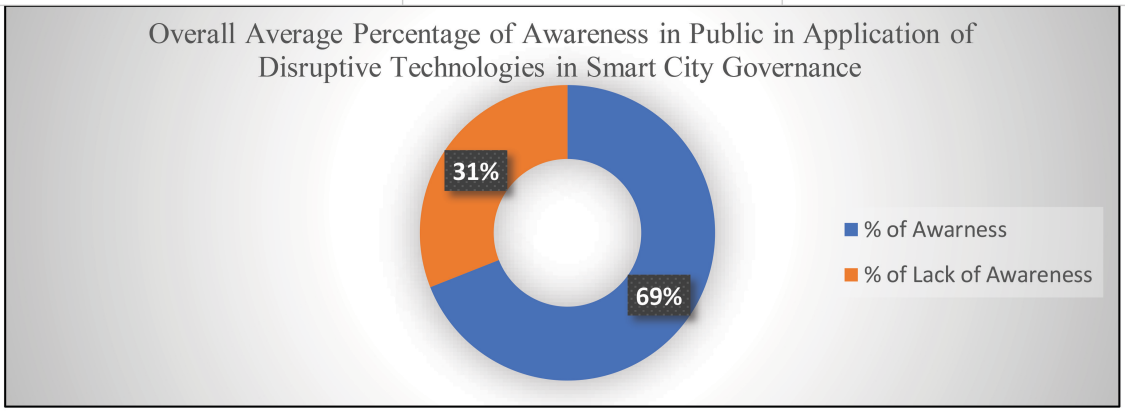

FIGURE 9 | Overview percentage of awareness of public on application of disruptive technologies in smart city governance.

academic institutions should be fostered to promote research and development in the field of disruptive technologies. This collaboration can lead to the creation of innovation hubs, incubators, and technology clusters where new ideas can be tested and implemented. It can also facilitate knowledge-sharing and capacity-building initiatives.

Pilot Projects and Demonstrations: Pilot projects and demonstrations of disruptive technologies in smart city governance should be implemented to showcase their practical applications and benefits. These projects can serve as living labs where citizens can experience firsthand how these technologies improve their quality of life. Regular updates and progress reports should be shared with the public to maintain their interest and engagement.

Public–Private Partnerships: Public–private partnerships should be encouraged to accelerate the adoption of disruptive technologies in smart city governance. By collaborating with private companies and startups, governments can leverage their expertise and resources to implement innovative solutions. Public–private partnerships can also help in funding and scaling up projects, ensuring their sustainability in the long run.

Multi-channel Communication: Multiple communication channels should be used to disseminate information about disruptive technologies in smart city governance. This includes traditional media channels such as television, radio, and newspapers, as well as digital platforms such as websites, social media, and mobile apps. The information should be presented in a clear and accessible manner to cater to different audience segments.

Citizen Feedback Mechanisms: Feedback mechanisms should be established to actively involve citizens in the development and implementation of disruptive technologies in smart city governance. This can include surveys, suggestion boxes, public forums, and online platforms where citizens can provide their input and ideas. Incorporating citizen feedback helps ensure that the technologies align with their needs and aspirations.

Collaboration between Smart Cities: Collaboration and knowledge sharing between smart cities in India should be facilitated to exchange best practices and lessons learned in the application of disruptive technologies. This can be done through forums, conferences, and networking events where city officials and stakeholders can share their experiences and insights.

Continuous Monitoring and Evaluation: The impact of disruptive technologies in smart city governance should be continuously monitored and evaluated to assess their effectiveness and identify areas for improvement. Regular feedback loops and performance metrics should be established to measure the outcomes and make data-driven decisions. This information can be shared with the public to showcase the progress and build trust.

Partnerships with Research Organizations: Research organizations should be collaborated with think tanks to conduct studies and research on the applications and implications of disruptive technologies in smart city governance. This research can provide evidence-based insights and policy recommendations to guide the implementation and regulation of these technologies.

7. Conclusion

The application of disruptive technologies in smart city governance has the potential to revolutionize how cities are managed and improve the overall quality of life for residents. Our research focused on five key disruptive technologies: Blockchain, AI, IoT, Big Data, and 3D Printing. Blockchain technology offers benefits such as enhanced

transparency, data management, and asset tracking in smart city governance. However, our study revealed that there is a lack of awareness among citizens regarding the application of Blockchain technology, with only 46% reporting knowledge in different areas of application. AI has diverse applications in city governance, including automated infrastructure monitoring, resource planning, traffic management, crime prevention, and emergency response. The majority of citizens (78%) demonstrated awareness of AI technology and its various applications in smart city governance. The IoT enables data collection, automation, and connectivity among devices and sensors, improving resource management, health monitoring, waste management, transportation systems, surveillance, pollution control, energy management, and e-services. While 80% of citizens reported awareness of IoT technology, there is still a significant portion (20%) with limited understanding. Big Data analytics plays a crucial role in gaining valuable insights from vast amounts of data collected in smart cities, leading to informed decision-making and improved service delivery. It helps optimize transportation systems, urban planning, and public safety. However, the level of public awareness regarding the application of Big Data in smart city governance was not specifically addressed in the research. Overall, while there are promising opportunities for the application of disruptive technologies in smart city governance, there is a need to increase citizen awareness and understanding of these technologies. Efforts should be made to educate and engage the public, ensuring that the benefits and potential challenges of these technologies are widely understood. By fostering citizen participation and collaboration, smart cities can leverage disruptive technologies to create more efficient, sustainable, and livable urban environments. By implementing the above suggestions, it is possible to improve public awareness and understanding of disruptive technologies in smart city governance. This, in turn, can foster greater support, participation, and collaboration among citizens, government agencies, and other stakeholders, leading to more successful and inclusive smart city initiatives.

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