EVALUATION OF SMART CITY AS A GLOBAL WONDER IN THE ERA OF ADVANCED TECNOLOGY

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Abstract

Top-notch and cutting-edge technologies such as mobile phone technology, digital/quantum computers, camera surveillance, robotics, Internet of Things (IoT), artificial intelligence (AI), machine learning (ML), Big Data, Digital Twin, etc. have radical changes on human culture, law, religion, work, etc., and that have greatly up-sated the normal order of things in the society. The use of these smart technologies in smart cities and business enterprises has been met with certain technological, economical, legal and ethical repercussions. The use of advanced technology presents many significant challenges including technological, economical, legal and ethical facet and that are primarily centered around data privacy, security, and accountability in the era of advance technology. Smart City is a city which uses advanced technology and innovation to improve the efficiency and productivity of services and city planning, to reduce the cost and resources utilizes by the city and target people. This model city emphases on a decent design and the contribution of the business sector and people in developing the city under the idea of a better and modern city. In smart city people will live comfortably, happily and sustainably, and have a good quality of life with safety and security. This article examines the status, benefit, and prospects of smart cities for global enterprises to meet the problems of the 21st century, keeping in mind the objective of smart cities. This study will also appraise the prospect and challenges along with ethical aspect of extensive and wide use of smart technology to develop smart cities.

Keywords: Advance technology, smart city, cyber security, comfort, service, digitization, IoT, AI

1. Introduction

Technology has woven itself into our lives, transforming everything from the way we communicate to how we handle legal matters. With innovations like Internet of Things (IoT), artificial intelligence (AI), machine learning (ML), quantum computing, and the legal field isn't untouched by these advancements. However, with technological progress comes the need to address ethics in technology. Legal ethics now involves understanding how these innovations impact confidentiality, accuracy, and privacy [1]. Our lives are made more convenient and easier by technology. We use technology, such as video calls and messaging, to swiftly communicate with others. Additionally, it facilitates fast access to information through search engines like Google. We can complete jobs more quickly and effectively thanks to technology. Today's society relies heavily on technology, which affects how you communicate, work, and make decisions. In the legal field, technology plays a significant role in ensuring confidentiality, managing factual discrepancies, and enhancing data security [2]. Let's delve into these aspects and see how they influence ethics and technology. Again, Generative AI is increasingly being used in legal systems to automate tasks like creating documents or assisting with research. This integration raises questions about legal responsibility, especially when AI makes autonomous decisions. For instance, if an AI system drafts a contract, who is accountable for any errors? As you work with AI, it's important to regulate its use to prevent inaccuracies. Consider a scenario where a law firm in Dhaka uses AI to draft contracts. They must ensure that the AI's outputs meet legal standards and that there's a system in place to review these documents [3]. These days, smart cities leverage data from cutting-edge technologies like IoT, AI, and ML to give residents better environmental cleanliness and safety. In order to meet the requirements of their residents and increase the effectiveness of service delivery, some cities also make use of IoT or AI devices [4]. Cybersecurity threats are one of the many threats that smart cities face, despite their high degree of connectedness and security. However, possible threats and attacks can be avoided with appropriate safety precautions. [6].

The steam engine, which altered manufacturing and transportation, was the first invention of the Industrial Revolution. Leaders like James Watt used this method to revolutionize entire industries and speed up progress. The advent of computers and the digital age accelerated the rate of creation [99]. By using technologies like the Internet of Things, AI-powered smart homes mark a significant advancement in sustainable living by lowering energy use, enhancing security, and enhancing comfort [5]. These systems can estimate maintenance requirements, modify environments, and manage resources on their own, which lowers waste and costs. In addition to transforming economic affluence through housing and technical innovation, the digital or smart revolution has also changed environmental sustainability [6]. Strong data privacy, cybersecurity, and ethical AI must be given top priority in smart home technology innovations. In order to prevent the negative effects of unchecked but intelligent technology, transparency, justice, and accountability are crucial because these systems handle sensitive personal data [16]. IoT, AI, ML, Deep Learning (DL), big data, blockchain, cloud computing, platform economy offers, big data, and algorithm-based decisions are currently revolutionizing the field of brain workers [119]. The complicated scenario affects not only auditors but also lawyers, engineers, doctors, data scientists, and computer scientists. In actuality, a few decades ago, leadership

was based on extraordinary skill. This focus is progressively diminishing. Through advancements in healthcare, education, transportation, housing, distribution, and other essential services, innovations in the fourth industrial revolution (4IR) can result in a higher standard of living. By encouraging innovation, opening up new markets, and increasing overall economic efficiency, the integration of 4IR technologies can promote economic growth and national development [14]. By giving everyone access to economic, medical, and educational opportunities, it is also paving the path to reduce social inequality, claims 4IR Energy Solutions [15]. Digital communication is convenient but poses significant challenges to confidentiality. Technologies like encryption and secure data storage are vital in maintaining privacy. Imagine you're a lawyer handling sensitive client information. Ensuring that this data is encrypted and securely stored is crucial [130]. The legal framework around confidentiality is evolving, and as a legal professional, you need to stay updated with these changes. AI systems can sometimes perpetuate biases or inaccuracies, especially if trained on flawed data. This is a significant concern in ethics with technology. For example, if an AI used in a court case relies on biased data, it could lead to unjust outcomes. Rigorous data validation and ethical AI development are necessary to ensure technology's outputs are reliable. As technology advances, so do cyber threats. Investing in robust cybersecurity measures is essential to protect user data. Consider a corporate law firm managing vast amounts of client data. Implementing AI-driven security tools can help detect and prevent cyber-attacks, maintaining trust in digital systems.

Liability and Accountability is determining legal responsibility when an autonomous or AI-driven system causes harm or a security breach is complex [6]. The issue of who is at fault and the manufacturer, the software developer, or the end-user and which is a significant legal question that evolving frameworks like the EU AI Act are attempting to address by proposing risk-based liability regimes. On the other hand, Data Ownership and Rights It is often unclear who owns the data generated by smart devices: the person generating it, the device manufacturer, or a third-party service provider. Legal frameworks are needed to clarify ownership, access, and usage rights, especially concerning data portability and cross-border data flows. Again, Intellectual Property (IP) is an emerging technology that challenges traditional IP laws, raising questions about ownership of AI-generated content and how to protect innovations like smart contracts within existing frameworks. AI, IoT, ML, and big data can be used for automation, data-driven decision-making, and predictive analysis by intelligent and modern company owners, CEOs, managers, or even any individual [38]. Numerous businesses, industries, service sectors, and facets of life benefit from these innovative technologies [17]. Bill Gates said, “As we look ahead into the next century, leaders will be those who empower others.” In several industries, technology is becoming increasingly advantageous. A digital and intelligent revolution is being brought about by technology. Leaders with intelligence need to adjust to new technologies. Without it, they are unable to lead and connect on a global scale. The workplace will change in the upcoming ten years due to AI and robots' capacity to automate tasks, improve decision-making, and streamline procedures. Massive data sets can be analyzed, patterns can be found, and accurate predictions can be made by AI-powered devices [41, 46]. This makes it possible for executives to make data-driven decisions, which enhances cost, accuracy, efficiency, competitiveness, and idea generation. AI may also automate routine activities, give men and subordinate more time to concentrate on strategic and creative work. This change in emphasis increases employee satisfaction and innovation. AI enables personalized team experiences, such as career paths and learning and development initiatives. Leaders may use AI and other contemporary technology to create a company that is future-proof, sustainable, flexible, adaptive, and purpose-driven, enabling it to prosper in the quickly changing military sector and future battlefield. AI enables students to personalize their learning. AI technology has the potential to improve teacher effectiveness and education. AI is used by big financial institutions to make investing easier. BlackRock's AI engine, Aladdin, assists customers in making financial decisions.

Eighty percent of the world's population is predicted to live in cities by 2050, when there will be nearly nine billion people on the planet. Just over half of the seven billion people on the planet now live in cities. City dwellers consume 80 percent of the planet's resources, although making up only 2 percent of the planet's land area. The conventional structures that cities rely on to supply resources are unsustainable, as are the cities' disproportionate use of social and physical resources and their rapid growth [7]. Local action is essential to attaining a low carbon future, even though urbanization continues to contribute to rising carbon emissions worldwide. Cities are now taking the initiative and creating plans to deal with the effects of climate change due to the lack of legally enforceable international climate action and the lack of leadership in many state governments. Cities are, in many ways, our best chance to combat climate change (World Urbanization Problem, United Nations, 2014) [8, 154]. By 2030, 70% of the world's population will reside in our global cities, which currently account for 80% of the world's GDP and are centers of innovation and commerce (World Bank). It is vital that we proactively determine what we want for our future cities and put in place mechanisms now that serve those future demands in a sustainable and integrated fashion because the appearance of these cities will have an impact on our environment globally [9]. Future consequences include optimized energy usage and improved mobility, but also present serious challenges regarding data privacy, security risks like cyber security, digital divide and many uncertainties [181]. Beside many prospects there are some major challenges including legal or ethical issues require a balance between technological innovation and the protection of individual rights and societal values.

Over the past century, there has been a notable improvement in the quality of life, mostly in terms of service access. However, administrators, architects, and urban planners have faced significant challenges due to the strong industry and population growth in urban regions. In the era of advance technology a major focus is transitioning to Net Zero through smart energy, waste management, and climate adaptation strategies [10]. The use of digital twins, artificial intelligence, and robotics is accelerating to create responsive urban environments. Real-time data collection enhances public services, such as, for instance, in traffic management and public transport. Future development emphasizes engaging citizens to ensure solutions meet actual needs, rather than just technology-driven initiatives. On the other hand, huge dependance on connected infrastructure introduces vulnerabilities, making cybersecurity a top concern [12]. Many of these cities have difficulties due to the enormous amount of capital needed for growth and upkeep. In addition, there are numerous ethical and legal difficulties. Regulatory and compliance issues, privacy concerns, and questions about intellectual property rights protection are just a few of these legal nightmares. [13]. Meanwhile, the ethical dilemma fluctuates between dignity, conscience, right and wrong, addictions, etc. The main legal challenges revolve around applying existing law to new, complex technologies and ensuring compliance with evolving regulations. Evaluating smart city initiatives becomes difficult without agreement on parameters [14]. Additionally, it makes it more difficult to compare projects and find best practices. The transformation of smart cities into "smart regions"—for example, by fostering greater cooperation between the public and private sectors—is the way forward [15]. In order to assess the opportunities and difficulties of smart cities in the twenty-first century, this essay will examine the evolution of smart technology. The complexity and process of striking a balance between the employment of smart technology and the defense of individual and collective rights as well as societal values in the complicated global context will also be evaluated and discussed in this article. In the dominion in the era of advance technology, smart skills, this research also emphasizes the importance of a suite of capabilities like communication, collaboration, problem solving, interpersonal skills, and job-specific advanced technical skills and that will be boosting employability and competence for future citizen. This is an analytical qualitative study on advance technology to evaluate the concept, elements, business, prospects, benefit, and challenges of smart cities in the era of advance technology along with legal and ethical aspect in contemporary age.

2. Literature Review and Methodology

The character of cities has always been multifaceted. In the era of advance technology cities must incorporate the use of big data and information and communication technology (ICT) into everyday operations and in the achievement of their urgent objectives if they are to become smart and sustainable—more ecologically sound, commercially successful, and socially just. As we swiftly move into the twenty-first century, it becomes clear that in order to keep up with the expanding population and limited resources, a city's total live-ability will need to take on a new dimension and horizon. The city will become a more livable place if technological innovation is combined with smart connectivity that makes use of the expanding Internet of Things (IoTs) to address the real problems of traffic congestion, waste/pollution control, and energy efficiency. Although smart city efforts are always a work in progress, communities worldwide stand a better chance of receiving the most livable award when they are carried out with actual business results and the specific demands of end users in mind. Therefore, through multilateral trading systems like those provided by the WTO, smart cities as they are now defined and understood have immense potential to open up in the worldwide business arena. Though descriptions and visions of the future city will still reflect the competitive dynamics between cities and the businesses and organizations that want to service them, the conversation about future cities is becoming more multidisciplinary, evidence-led, and conceptually rigorous. Most people's lives, whether or not they reside in a city, will be directly impacted by the shape, functionality, look, and atmosphere of cities in the future. In addition to its effects on people, the future city will have an impact on economies and broader global environments. Economically speaking, the biggest metropolitan marketplaces have already surpassed those of several countries.

Numerous disputes and public discussions have been sparked by the new environmental challenges. Degradation of the environment is becoming a worldwide problem. An estimated trillion tons of carbon dioxide would be added by 2050 if current emission rates continue, according to the literature, which could have a negative impact on human existence [166]. In recent years, there has been research on the function and significance of ICT for various economic outcomes. Increased use of information communication technology (ICT) has been shown to have positive economic effects [167]. Nonetheless, the literature has paid the least attention to ICT's ecological aspects. ICT has actually had an impact on human life from a variety of angles, including ecological ones. However, ICT is seen as a way to strengthen environmental protection, lessen the negative effects that human activity has on the environment, and tackle important environmental issues like sustainability and climate change. By raising knowledge of environmental issues and encouraging the use of ecologically friendly technology, ICT can also aid in reducing environmental damage [168]. Environmental dangers can be anticipated and managed with the aid of ICT technologies. Computerized simulation tools, for instance, can make "learning by simulation" easier in order to speed up decision-making processes and avoid the negative effects of trial and error. The "internet network" is another component of ICT that enhances environmental awareness. Due to their ability to lower greenhouse gas emissions, ICT-based solutions are regarded as beneficial for environmental sustainability [169].

The legal and ethical implications of these developments cannot be disregarded in the age of smart cities, when the integration of IoT, AI, and other smart

technologies promises previously unheard-of levels of efficiency and innovation. Questions around data privacy, surveillance, cyber security, and the ethical use of technology become more pressing as urban areas become more globally connected and accessible through the internet or web. The gathering and use of personal data as well as open connectivity to the outside world are among the main issues in the context of smart cities [128]. IoT devices and AI technology collect data from a variety of sources, including sensors, cellphones, and security cameras. Therefore, establishing strong data privacy legislation becomes essential. To guarantee that people's or personal information is handled responsibly, openly, and with the highest level of security, smart cities must abide by strict data protection rules. Concerns regarding citizen privacy are brought up by the use of surveillance technology, such as voice and facial recognition and video analytics. Finding the ideal balance between protecting individual rights and maintaining public safety is a difficult task. Clear rules and guidelines controlling the use of surveillance technology are necessary in smart cities to guard against misuse and shield residents from unjustified intrusions into their personal life. It is essential to make sure that people are aware of how data is collected in smart cities. People are empowered to make educated decisions about their involvement in smart city efforts when there are open communication and explicit agreement is obtained for the gathering and use of personal data [186]. This openness promotes a cooperative and moral approach to urban development by increasing trust between citizens and city officials.

Because IoT devices are interconnected and use AI, smart cities are vulnerable to cyberattacks. It is crucial to safeguard the infrastructure from possible threats and secure the data that is sent between devices. To prevent unwanted access and preserve the integrity of the data gathered, smart cities must have strong cybersecurity measures in place, such as encryption methods, frequent software updates, and intrusion detection systems [25]. The Internet of Things (IoT) and artificial intelligence (AI) are major forces behind efficiency and creativity in the age of linked technology and smart cities. However, the crucial relevance of cybersecurity cannot be understated given the growth of smart cities and the proliferation of connected devices. The importance of cybersecurity in the context of IoT and smart cities is examined in this blog post, which also outlines best practices for protecting infrastructure and data. Mobile phones can determine where and when we cast our ballots by tracking us as we shop. Drones monitor our neighbors and provide drinks to fishermen in the middle of a frozen lake, and algorithms based on commercial data enable businesses to sell us goods they believe we can afford and refrain from displaying those they believe we cannot. One day, autonomous cars will talk to each other to reduce traffic jams and, consequently, energy usage. Technology has repercussions, challenges conventions, alters our abilities and actions, acts on our behalf, and renders biased judgments [64]. There are drawbacks to using this technology, particularly with regard to human privacy and emotional and financial stability. Technology use can lead to moral dilemmas, political challenges, and a host of other legal issues. The combination of these technologies and their negative impacts is what gives rise to ethical issues surrounding the usage of smart and contemporary technology.

Smart cities are vulnerable to cyber threats due to the interconnectedness of IoT devices that use AI. It is crucial to secure data being sent between devices and to defend the infrastructure against possible threats. To prevent unwanted access and preserve the integrity of the data gathered, smart cities need to have strong cybersecurity measures in place, such as encryption methods, frequent software updates, and intrusion detection systems [25]. The Internet of Things (IoT) and artificial intelligence (AI) are major forces behind efficiency and creativity in the age of connected technology and smart cities. However, the crucial significance of cybersecurity cannot be emphasized given the growth of smart cities and the proliferation of connected devices. This blog post examines the critical need for cybersecurity in the context of smart cities and the Internet of Things, exploring potential threats and describing recommended practices to protect infrastructure and data. Mobile phones can determine where and when we vote by tracking us while we buy. Drones observe our neighbors and provide drinks to fishermen in the middle of a frozen lake due to algorithms based on commercial data that allow businesses to offer us things they believe we can afford and avoid displaying us things they believe we cannot. By communicating with one another, autonomous cars will eventually reduce traffic jams and, consequently, energy usage. Technology affects our behavior, challenges conventions, alters our capabilities, acts on our behalf, and produces biased results [64]. There are drawbacks to using this technology, particularly with regard to human privacy and emotional and financial security. Technology use has the potential to influence and elevate political issues, moral concerns, and several legal challenges. Modern technology use raises ethical questions because of the confluence of various technologies and their negative impacts [188].

With over 95% of the world's population now connected to mobile networks in the twenty-first century, closing the digital divide both within and between nations was essential, and we must never forget that information and communications technologies (ICTs) are always beneficial for development. In the modern era, ICT is a useful instrument for reducing environmental deterioration. Large volumes of sensitive personal, behavioral, and environmental data are now collected by smart devices, making adherence to strict data protection regulations necessary. The stories about how technology will eventually interact with people and the myth of digitalization have finally come to pass. Nature has been profoundly altered by technology in previously unimaginable ways. The world is in awe of the entrance of mind-blowing technologies like robotics, the Internet of Things, artificial intelligence, machine learning, and smart devices like computers, phones, watches, and cameras. Nearly every aspect of human life, including society, has seen significant change as a

result of this contemporary technology. Politics, election trends and analysis, financial analysis, economic growth, social life, medical, education, energy, religious beliefs, and other areas are all significantly impacted by modern technology. Thanks to artificial intelligence (AI) and automation, humans may now effectively engage with technology in the twenty-first century. There are numerous facets to important regional and global frameworks. A strict EU framework that requires user consent, data minimization, transparency, and the right to be forgotten is the General Data Protection Regulation (GDPR). Alternatively, California customers have the right to know what data is collected and to request that it be deleted under the California Consumer Privacy Act (CCPA). Another is the Health Insurance Portability and Accountability Act (HIPAA), a federal law in the United States that regulates the security and privacy of personal health data gathered by smart health devices. However, while both Singapore's PDPA and Australia's Privacy Act are national laws that protect personal data, they differ in their enforcement and scope. The Australian Privacy Act, which is based on 13 APPs, regulates handling across sectors with a strong emphasis on individual access and transparency [144]. Once more, the Singapore PDPA, which is overseen by PDPC, establishes baseline guidelines for the gathering, use, and disclosure of data. It was recently improved with stricter penalties and guidelines for reporting data breaches. Both seek to strike a balance between organizational requirements and data protection [145].

This research has used the worktable, which consists of the review of documents and pertinent literature in this area, in order to accurately ascertain the ethical and legal ramifications of current technology. The completion of this research project has been made possible by the consultation and collection of important information from documents such as books, papers, journals, newsletters, and laws. The completion of this work has also benefited greatly from the internet, a primary data collection tool. The majority of these documents have provided insight into how technology functions and acts in general, which has greatly aided in the development of this article. Law analysis has also revealed a significant discrepancy between the rules governing important corporate, social, and economic facets of society prior to the emergence of digital or smart technologies and the recent significant advancements in technology [120]. Several AI tools, such as ChatGPT, have been utilized to gather pertinent data in order to provide a hands-on example of the benefit of technology. AI can collect data in minutes that 30 workers could collect in a week. The money that would have been spent on transportation, food allowance, paperwork, and documentation may now be used for other business-related expenses, which results in cost savings. Meetings that could have been held in person, with all the costs associated with arranging logistics, hiring staff, etc., can now be ignored because they can be handled conveniently and comfortably online. Just think about how much money a company or training school/institutes will spend to book tickets for her employees' flights, meals, and lodging when they are attending training overseas or in a far-off place. Thanks to technical advancements and astute business practices, these meetings, conferences, and gatherings may be conducted virtually for very little money. Data professionals may gather and analyze ever-increasing amounts of data more quickly and effectively when AI and data analytics are combined [63]. Productivity and efficiency are the keys to success in the fast-paced world of business. The same holds true for personal achievement in contemporary life. Because technology can automate monotonous work, minimize manual errors, and speed up procedures, organizations, businesses, and even astute citizens who embrace it are discovering that they have a clear advantage. In addition to saving money, this increased efficiency helps companies become more productive and profitable [115, 186].

Smart cities in the era of advance technology utilize IoT, AI, ML, Big Data, Digital Twin, and data analytics to enhance sustainability, efficiency, and quality of life, addressing rapid urbanization and climate challenges toward peaceful and smart living. Important prospects include intelligent traffic, smart grids, and citizen-centric services, though high implementation costs and cybersecurity risks remain significant challenges. Digitalization and the application of smart technologies make production and distribution, as well as the manufacturing of goods and services, comparatively simple, precise, and quick. Contemporary technology is designed to be flexible. It can adjust to changes in the business environment, pricing, quality, quantity, and kind of goods or services because of its independent and effective character [121]. The new pricing labeling in a supermarket can be easily reprogrammed and mastered by modern computer or AI systems. Therefore, modern technology is a strength because it keeps the organization, firm, business, or even the everyday work of a smart citizen current and present regardless of changes that take place in the course of business or odd events. There is increasing demand to make cities more environmentally friendly while also increasing their efficiency as urbanization rates rise and governments throughout the world set aggressive goals to cut carbon dioxide emissions. Over two-thirds of the world's CO2 emissions come from cities. Some have taken up the task and are managing the difficulties of urban sustainability with the aid of technology [170]. Complex jobs, simulations, calculations, and other tasks can be completed 100 times faster by computers, IoT devices, and artificial intelligence (AI) systems than by the human brain. Smart technology, including artificial intelligence (AI), the Internet of Things (IoT), machine learning (ML), data science, big data, and ICT in general, is made up of various computer components and technological fusions that can readily adapt to human nature and carry out tasks more quickly and independently. An intelligent bottle, for instance, can cock bottles in minutes, but it will require 100 workers working long hours to complete the same activity. Given that time is the most valuable resource in the business world, this efficiency is a welcome boon.

Cities that are managed more effectively can increase economic growth, lower expenses, and increase productivity. Government assistance, technology innovation, and necessity are driving this movement toward smart, sustainable cities. Secular growth should benefit businesses that offer answers [15]. Despite being widely discussed, the term "business model" is relatively new and lacks a standard definition [155]. A business model explains the logic behind how a company generates, provides, and acquires value (economic, social, cultural, or other forms of value). A business model is defined as "an architecture of the products, services, and information flows," which is one of the most commonly used definitions. Actors, roles, potential economic value, and the revenue source are all acknowledged in this definition. Four components make up a business model framework, often known as a "canvas," which centers the value proposition. [150, 156]. According to Roy (2005) [157], business models can be categorized into five categories, despite the possibility of different value propositions. Unbundling business models are useful for companies that operate in the three essentially distinct business categories of infrastructure, product innovation, and customer relationships like private banking. A company that uses the long tail business model aims to sell more for less. Offering a wide variety of specialty products, each of which sells comparatively infrequently, can help address this problem like LEGO. Multi-sided platform models, which combine two or more separate yet connected client groups like game console production vendors. Free business model: consistently provide a free offer to at least one significant consumer category like cell phone operators. Unbundling business models are useful for companies that operate in the three essentially distinct business categories of infrastructure, product innovation, and customer relationships like private banking.

More sophisticated threats are always emerging, and the environment of cyber security is constantly changing nowadays. Since the pandemic, businesses and individuals have become increasingly dependent on technology, which has given hackers a special chance to take advantage of their weaknesses. Actually, there has been a 600% surge in cybercrime since the pandemic started. Sadly, most small and medium-sized business owners (SMEs) are not sufficiently equipped to protect themselves from a cyberattack, even though they are the most vulnerable. There are several reasons for this, including as inadequate cybersecurity plans, undertrained staff, and antiquated IT hardware and software. You must address this technological issue head-on because the majority of SMEs fail within six months of a cyberattack. Effective protection can be established by collaborating with the appropriate outsourced IT support company [122]. Automation has the potential to increase productivity, but it also puts certain jobs at risk of being replaced. Employee morale and corporate culture may suffer if there is less demand for some job positions as a result of increased reliance on technology [116]. There are many advantages to using AI, ML, robotics, or information and communication technology (ICT) in business, but there are also risks and complicated legal issues involved. The following are some of the main risks associated with ICT use in businesses: old or malfunctioning hardware, software, or network components that can cause system crashes, data loss, and service interruptions. inadequate redundancy or backup solutions to guarantee the uninterrupted availability of vital IT resources in the event of emergencies or failures [117]. Once more, the widespread usage of smart gazettes, devices, and systems will raise significant ethical and legal concerns in the future. The impact that modern digital technologies have brought to bear on human activity such as politics, education, the economy and businesses across the globe is so alarming [188].

3. Chronological Development of Technological and Industrial Revolution

Technology from Primitive Age. Humans differ from other animals in that our capacity to convey and receive information improves our capacity for abstract thought. The reason we were at the top was our superior intelligence. Compared to a few hundred thousand years ago, human technology would have taken a million years to become economically viable enough to support an extra million people since it develops slowly. This time frame was shortened to two centuries by the Agricultural Revolution of 5,000 BC. It further decreased to just 90 minutes in the years after the Industrial Revolution. Technological developments like the creation of super-intelligent (SI) machines have the potential to drastically alter the world as we know it. The concept of superintelligence was explored in 2014 in relation to the possible societal repercussions of building a machine with greater intelligence than humans. These conversations provide a thorough understanding of the super-intelligent future and how we could get there, supported by facts, statistics, and research from a variety of fields. However, the condition of contemporary technology is the main focus at the moment. By analyzing data entered by humans, we have already been able to build machines that can learn and reason. One excellent example is the automatic spam filters that safeguard important information and keep our inboxes clear of unsolicited bulk emails. However, this is still a long way from the "general intelligence" that humans possess, which has been the goal of AI research for many years. Furthermore, it might yet be decades before a super intelligent computer that can learn and operate on its own is created. But the field is developing quickly, and a machine like this might be available sooner than expected. Its intelligence could have a profound impact on our lives and could even be dangerous because it might be too advanced for us to turn off in an emergency [76].

Although imitation can take many different forms, it can be used to develop technology. As a result, although some scientists are in favor of building a computer with artificial intelligence that can mimic people, others want an exact replication of human biology, which may be accomplished through techniques like whole brain emulation (or WBE). The majority of the most important discoveries in human history have ei-

ther been the result of substantial international cooperation or of individual scientists accomplishing a goal before others. If a team of scientists could find answers to the problems preventing AI and WBE in a short amount of time, they could probably build a single super-intelligent computer. This is because the industry is highly competitive, which would require such a group to operate covertly. Let's look at the possibilities for the development and application of general intelligence technology before we get scared of the impending machine-led disaster. The increased accessibility of technology and its decreasing cost are projected to promote the mass production of robots that can perform tasks that currently require human hands and minds [77]. This suggests that not only will machines take the place of all human labor, but they will do so with ease. A robotic workforce will have a significant impact on the economy, as well as our desires and lifestyles. Workers' earnings will fall until no human can live on a salary as machine labor becomes the new, less expensive norm [78]. In addition, the mechanical industry would see a small number of employers amass vast wealth. But this brings us back to a previous argument because where the money ends up depends on whether SI is created by a single, exclusive group or develops gradually through a collective process. If the former is true, most people's potential to make money would be limited since they would have to rely on their pensions, savings, or rental properties [79]. However, the expansion of SI is linked to a number of safety hazards that, in the worst cases, could lead to the extinction of humanity. Examining the logic behind the SI we create can help construct specific protections, but this won't be sufficient on its own.

Industrial Revolution and Complex Global Order in the Era of Advance Technology. As we speak, advances in sophisticated and intelligent technologies that span the digital, biological, intellectual, and physical domains are essentially transforming the global economy. The world is transforming as a result of emerging technologies including automation, robotics, AI, ML, DL, IoT, big data, and blockchain [80]. Globally, the industrial revolution is still running strong. It can be explained by the shift from manual to machine-based manufacturing, which had a significant impact on society and had worldwide repercussions. Although it brought about economic progress, reduced costs, and higher output, it also brought about social issues including environmental degradation and worker exploitation. The steam engine, power loom, and mass production methods were examples of innovations that transformed industries and encouraged continued expansion. It contributed to the establishment of Western supremacy by dramatically widening the divide between industrialized countries and the rest of the globe [81]. AI is going to change and upend products and service paradigms. Innovative and disruptive service models created by big data analysis of individual customer wants rather than corporation demands will transform the service industry, even while technical advancements primarily increase industrial efficiency [82]. Below is a summary of the industrial development timeline.

INDUSTRY 1.0: INDUSTRIALIZATION: Industry 1.0 marks the beginning of the industrial period in the 18th century, which is known as the first industrial revolution and was characterized by the first use of machinery to produce goods and services. Among the biggest developments were the development of heavy industry, railroads, and coal mining. The most important development of this era was the steam engine, which caused social unrest and the eviction of many workers. Because they provided a flexible energy source that could be used anywhere, steam engines were first used in Great Britain's industries in the late 18th century, which promoted industrialization [83].

INDUSTRY 2.0: ELECTRIFICATION: The advent of electrification in the late 19th century marked the beginning of the second industrial revolution. The assembly line, which was initially used in the automotive industry, developed into the steam engine's industrial equivalent at this time, enabling the automation and speeding up of production processes. The sequence of specific tasks that employees perform in Industry 2.0 demonstrates the division of labor, leading to the rise of serial manufacturing. Furthermore, the first automated product delivery between continents was made possible by the introduction of international shipping technologies, such as airplanes [84].

INDUSTRY 3.0: DIGITALISATION: The advent of electronics-driven automation and information technology marked the start of the third industrial revolution in the 1970s. The widespread adoption of personal computers and the internet significantly increased the integration of technology in the workplace. As a result, labor processes became more automated, and global information access increased. Additionally, in mass production, robots replaced human labor. At that time, this trend was already on the horizon and was intensified during Industry 4.0 [85].

INDUSTRY 4.0: AUTOMATIZATION: Industry 4.0, also referred to as the fourth industrial revolution or 4IR, entails incorporating cyber-physical systems (CPS) into logistics and manufacturing processes as well as connecting commonplace items via the Internet of Things. Value creation, business models, downstream services, and work organization are all impacted by services in industrial processes [86]. AI, IoT, ML, DL, big data, blockchain, and other smart technologies are all included in CPS, which refers to network connections between people, machines, products, things, and ICT systems. Over 100 billion devices will be connected in the future. The 4IR differs from the 3IR in the service industry due to AI.

Four essential elements define the word "automatization" in industrial production: 1) Production operations are managed by machines. Thanks to clever technology, most production in the future will be automated, with human involvement occurring only seldom. The "smart factory," which has little to no human presence, is an example of this tendency [87]. 2) Real-time production is a key feature of Industry 4.0. The ideal utilization capacity of the industrial facility is determined by an intelligent machine. Lead times are short in the production process, and standstills—apart from those brought on by technical flaws—can be

avoided. To satisfy the needs of the value creation chain, resources, information, and commodities are carefully coordinated. Stocks are kept to a minimal, but when the amount required for manufacturing drops below a predetermined level, the machine automatically buys more supplies. The same concept holds true for completed goods; the machine minimizes storage costs by producing in accordance with overall demand and incoming orders [88]. 3) Decentralization of production: The machine, which includes a network of manufacturing units, is essentially self-organized. Order handling is fully automated in addition to material planning [89]. 4) Tailored production, even for individual pieces: As long as they stay within predetermined bounds, robots will eventually be able to respond to certain customer needs without the need for human adjustments. Changeover times are less necessary as a result. In order to accommodate customer needs and preferences, the smart factory incorporates additional components or, in an appropriately dispersed process, adjusts particular manufacturing processes [90].

The phrase "4IR" denotes the exponential advancement of technology in the twenty-first century [91]. The 2016 World Economic Forum Annual Meeting [92] in Davos-Klosters, Switzerland, will focus on the topic of "Mastering the Fourth Industrial Revolution." The global production and supply network is undergoing fundamental changes in this era as a result of the continuous automation of conventional manufacturing and industrial processes using contemporary smart technology, large-scale machine-to-machine communication (M2M) [93], and the Internet of Things. This integration has resulted in the deployment of intelligent robots that can assess and diagnose problems without human intervention, improved communication and self-monitoring, and increased automation [94]. AI, robotics, IoT, biotechnology, and nanotechnology are among the digital, physical, and biological technologies that combine to make it [95]. Infosys BPM asserts that Industry 4.0 is transforming the manufacturing and production sectors, leading to more automation, streamlined supply chains, and personalized products. In order to achieve the objectives of universal energy access and net-zero emissions, 4IR technologies are needed for the integration of renewable energy, smart grids, and energy storage systems, as per ScienceDirect.com. [96] . The education industry is changing as a result of 4IR, necessitating the incorporation of digital literacy, creative teaching techniques, and public-private partnerships. Personalized treatment, remote patient monitoring, and sophisticated diagnostic tools are some of the ways that 4IR technologies are transforming healthcare [97]. It seeks to use cutting-edge technologies to build a more sustainable, just, and affluent future for everybody.

Because of their autonomous communication via sensors and associated technological networks, 4IR's production process components—such as machinery, operational resources, software, and others—have significantly improved [98]. By reducing production expenses, particularly in personnel planning, 4IR seeks to improve the company's standing in global competition [99]. It uses advances in digital, physical, and biological technologies to change how we live, work, and interact with each other. In order to alleviate social and economic inequality and build a more productive, efficient, and sustainable future, it aims to combine various technologies. Delivery drones, autonomous cars, "smart factories," and 3D printers—which can create extremely complex structures from a template without human assistance—are well-known instances of robotics and artificial intelligence. Car sharing, Spotify, Netflix, Uber, Airbnb, Facebook, and Amazon Mechanical Turk are examples of popular service models. Studies show that in just ten years, sector turnover will increase twentyfold due to service sharing [100]. However, 4IR has been developed with intelligent technology to improve resource use, cut expenses, and streamline procedures across a range of industries, resulting in higher productivity and efficiency. It is fostering the emergence of new sectors and employment prospects, especially in fields that demand a skilled labor force, such as artificial intelligence (AI), robots, biotechnology, smart shipping, smart transportation, smart healthcare, and data science. The World Economic Forum stated that by encouraging sustainable energy solutions, improving resource management, and lowering pollution, 4IR technologies can be extremely helpful in tackling environmental issues [101]. Human-centeredness, which emphasizes improving human well-being, conserving cultural heritage, and advancing societal ideals, is a fundamental component of 4IR [102].

Influence of AI in the Era of 4IR. Artificial intelligence has been pervasive for a long time. Our daily lives are continuously improved by its benefits. The technology is used in robots that greet clients at shopping malls and in internet search engines that provide suggestions [103]. AI systems today mimic human analysis. It indicates a computer program's ability to think and learn. Any system that uses a software to carry out tasks typically associated with human intellect is referred to as artificial intelligence (AI). The developments in AI have led to the realization of numerous benefits across various industries [104]. Today, projections are becoming more precise, and convenient technology is widely available. Procedures are also effective and efficient. AI ensures continuous business operations by optimizing data backup and disaster recovery options. Even though the key elements of successful technology and IT leadership are always changing, the need for a solid business plan, a clear vision, and effective IT management endures. Furthermore, there is still a strong requirement for an informed approach to outsourcing, AI, risk, and compliance [105].

Human potential is being enhanced by digital life, which is also upending conventional human activity. Currently, code-driven systems are used by more than half of the world's population, offering referable opportunities as well as previously unheard-of challenges [107]. AI optimizes data backup and disaster recovery solutions to ensure continuous business operations. Even while the essential components of successful technology and IT leadership are always evolving, the need for a solid business strategy, a clear vision, and

effective IT management endures. Furthermore, the necessity of a knowledgeable approach to outsourcing, AI, risk, and compliance is still steadfast [108, 129]. Experts predict that while networked AI will increase human productivity, human autonomy, agency, and capacities will be compromised [109]. When it comes to complex decision-making, learning, reasoning, pattern recognition, visual perception, speech recognition, and language translation, computers can perform better than humans. In addition to saving time, money, and lives, intelligent systems in cities, automobiles, buildings, utilities, agriculture, and commerce may also give residents a more personalized future [110]. AI has significant potential in healthcare, with applications ranging from improving the quality of life for senior citizens to diagnosing and treating patients. They were particularly excited about the possibility of AI being involved in an all-encompassing public health initiative that would utilize the potentially enormous amounts of data on subjects as varied as diet and individual genomes that may be gathered in the years to come [41]. AI could help bring about much-needed reforms in both official and informal education.

Figure 1: AI and the future of life and working relationship between human and robots [62, 106]

Our culture is changing noticeably as a result of incorporating AI and the Internet of Things into our everyday lives. Artificial intelligence-powered devices will soon be able to take our pulses in medical facilities, and internet merchants will soon be able to customize their product recommendations for each customer. These are only a few of the numerous ways artificial intelligence enhances human life. AI will provide a lot more in the future. As time goes on, an increasing number of companies, nonprofits, and governmental organizations will begin utilizing this revolutionary technology to improve and simplify all facets of human existence [113]. By increasing workplace productivity, assisting individuals in making better decisions, and providing direct assistance, artificial intelligence (AI) can simplify and speed up processes in the neighborhood, society, nation, and world. AI can help by spotting and fixing problems that people might not be able to find or fix on their own. However, some people may not see the advantages of artificial intelligence because they think it would make people less intellectual and cause them to lose their employment. The speed, accuracy, efficiency, and scalability of artificial intelligence are its greatest benefits [38].

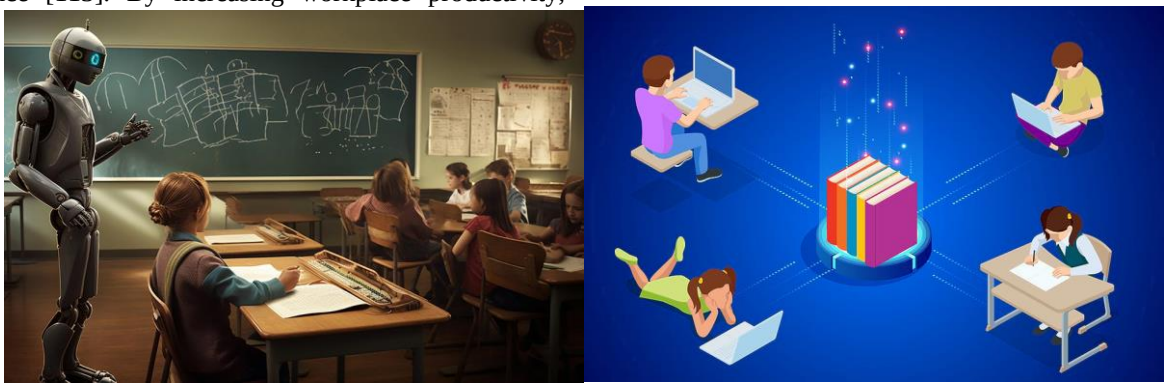

Figure 2: Role of AI in education system [111] and revolution of future education system [112]

The 4IR will have a huge impact on many industries, service sectors, and other areas, making a large amount of the current work inaccessible over the next 25 years. We must have a thorough awareness of how these changes will impact all facets of our lives, including academic and educational institutions [114]. Today's graduates must contend with a world transformed by technology. AI, the internet of things, machine learning, big data, cloud and edge computing, and social media present traditional educational institutions with a number of benefits and drawbacks. Traditional educational institutions worry about their students' prospects, particularly in regard to jobs, as they prepare for life beyond high school or college. Concepts like "post-work" are beginning to define our era as a result of the profound changes in the world brought about by the pervasive influence of AI-powered modern technology [140]. The abilities required in this era are substantially different from those in the Third Industrial Revolution

because information technology (IT) is now the primary driver. Over the next seven years, the US's artificial intelligence and other smart technology sectors are expected to grow to a value of $15 trillion. People who have received traditional education but lack the requisite skills will be laid off in large numbers [115]. On the other hand, millions of jobs requiring high-tech and modern skills will be created in the next years [116]. Today, managing the ethical and legal issues becomes essential to responsible urban development as smart cities emerge. Smart cities can set the stage for a digital future that respects the rights and values of the communities they serve while simultaneously embracing innovation by setting clear legislation, giving data privacy top priority, encouraging openness, and actively involving citizens. The secret to designing smart, inclusive, and individual rights-respecting urban environments is striking a balance between ethical ideals and technical advancement [143].

Figure 3: In future robots will work with human [123] and the chronological revolution [124]

4. Smart City is a Global Phenomenon in the Era of Advance Technology

In the era of advance technology, a smart city integrates digital technologies into its networks, services, and infrastructure in order to become more efficient and livable, thereby benefiting residents and businesses. According to the European Commission, a smart city requires: Smart urban transport networks; Improved water supply and waste disposal facilities; More efficient ways to light and heat buildings; More interactive and proactive city administration; Safer public spaces. In other words, a smart and sustainable city uses information and communication technologies (ICT) to improve quality of life, efficiency, and competitiveness, while ensuring that the needs of present and future generations are met. According to the United Nations Economic Commission for Europe (UNECE), the definition of a smart city includes elements such as widespread home connectivity and Wi-Fi in public areas, smart infrastructure, smart meters, the use of open data, and e-government solutions [186]. The Smart City concept has become a key factor in sustainable urban development. It is a compilation of urban planning strategies with lots of far-reaching benefits, including efficient distribution of resources, speed of policy implementations, seamless communication, and a range of environmental benefits. A city's "smartness" is determined using a set of characteristics, includes infrastructure based around technology, environmental initiatives, effective and highly functional public transportation, progressive city plans, people able to live and work within the city using its resources, etc. The success key of a smart city relies on the relationship between the public and private sectors as much of the work to create and maintain a data-driven environment [63, 186].

A smart city is a technologically advanced metropolitan region that combines explicit information from sensors and numerous electrical strategies (Hossain, 2026c). The information gathered from that data is used to effectively manage resources, assets, and administrations; as a result, that data is used to advance duties throughout the city [17]. This includes data collected from inhabitants, devices, buildings, and resources that is processed and examined in order to track and control AI, web technologies, smart mobile platforms, telecommunications, e-commerce, e-business, and other technologies are all integrated in smart cities and smart businesses [18]. In Figure 4, the fields of utilization pertain to services for citizens and users, such as utilities, e-health, transportation, and structures. Information and communication technologies (ICTs) are used in smart cities to scale services like transportation and utilities for a growing population. Growing urbanization and population growth are igniting a fresh interest in incorporating technology into the planning of municipal services, which is what "smart cities" are all about [19]. In order to detect variables like temperature, moisture, allergens, contaminants, traffic, and power matrix status, smart cities heavily rely on sensors. These parameters' values offer a context that aids a system in comprehending a citizen's condition at any given time [187]. So, smart city encompasses all important element of citizen comfort and safety like, governance, banking, society, public safety, health care, environment, transport, mobility, etc. as shown in figure 4 below.

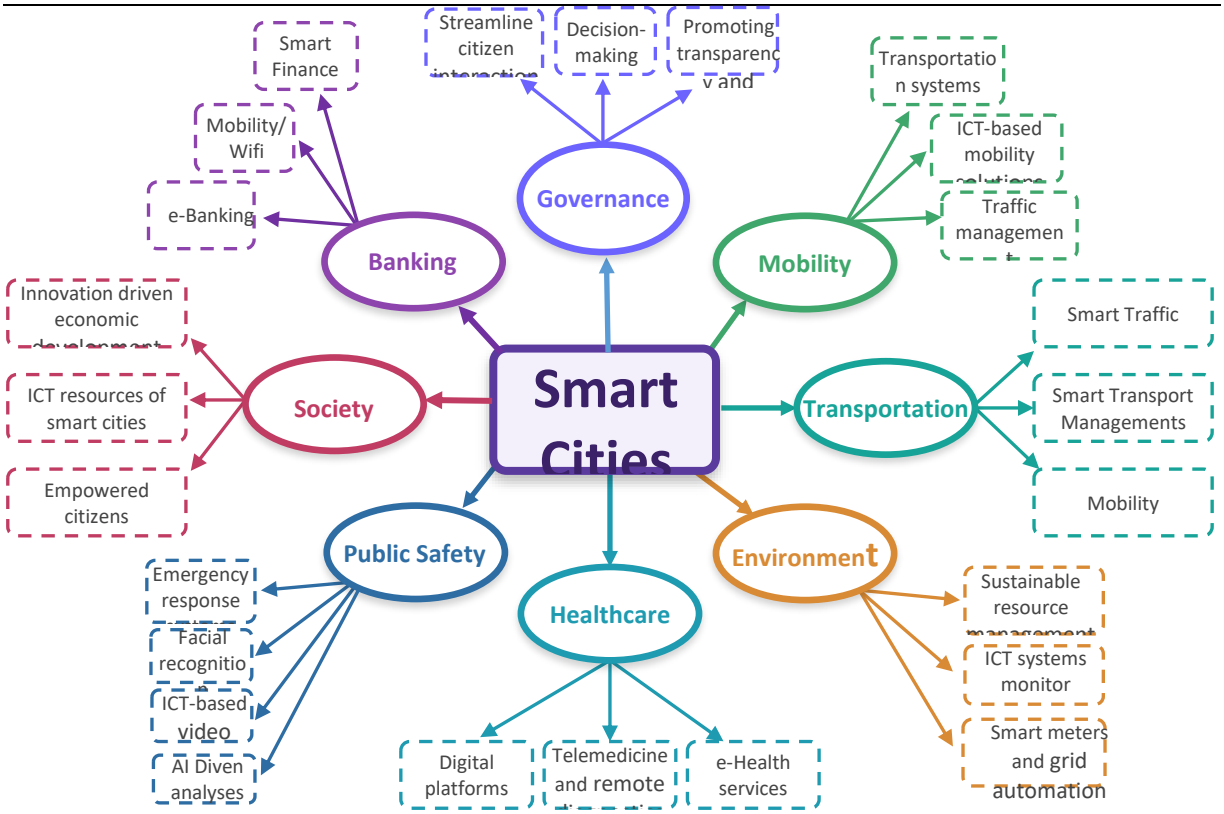

Figure 4. Many useful and efficient utilities and comfort in smart city

The multi-tier design is used in nearly all large, well-managed smart cities in an effort to combine the physical and ICT environments. Smart cities, however, seem to be adopting another intriguing strategy that involves the Internet of Things, artificial intelligence, robots, and automation. This means that many smart cities could use data from sensors, buildings, and users as sensors with their applications without having to install networks or other large-scale infrastructure from scratch. Any or all of the elements of smart cities could be mentioned in potential business models. For example, vendors in smart cities create and implement infrastructure; operators profit from the use of these facilities or the supply of services; service providers profit from the provision of their services, etc. To do this, a smart city might make use of a variety of modern business models [186]. A city can be viewed from a number of perspectives, some of which are already present while others require design. The dimensions are environment, public transportation, infrastructure, health, education, social welfare, finance, etc. A smart city environment includes parks, buildings, lakes, rivers, and landscapes. Smart city open Data, innovation, synergy, cooperation, and creativity make up the collaboration system [187]. Smart city includes e-government, e-learning, and e-traffic are solutions. Where smart city living: working, recuperating, and having fun. However, smart city components like smart infrastructure, smart governance, and smart mobility, smart transport, smart healthcare, smart education, etc. and those work together to improve city life with comfort, security, and safety and that has been shown in figure 5 below. These elements use digital and smart technology, data, and connectivity to manage resources well with efficiency and optimization.

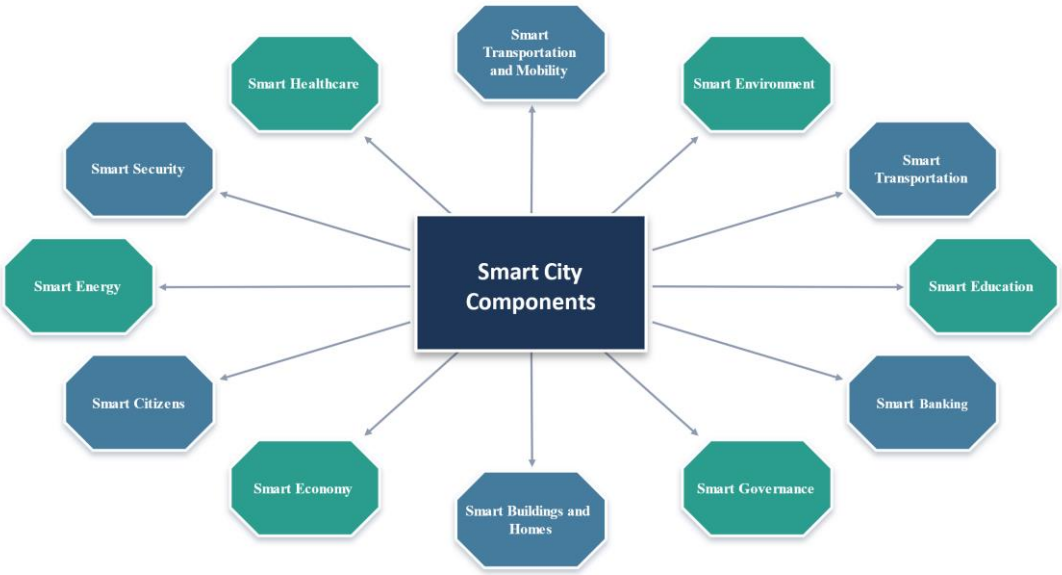

Figure 5: Components of smart city to manage resources effectively

The interactions between the different disciplines in a smart city offer the greatest potential for value creation. Additionally, services made possible by technology should be mentioned while discussing smart cities. People and their needs are frequently disregarded in this situation. In figure 6 provides a visual representation of the importance of the value of people in a smart city. It is important to keep in mind that a smart city is built for the people, not for its own purpose. It is now necessary to connect disciplines and sectors that did not previously interact closely in a way that adds value. Smart city initiatives are frequently approached solely from a technological standpoint. Nonetheless, it is crucial to address a number of other non-technological factors, including organizational settings, societal culture, and the culture of city management departments (viz. municipalities, corporations, district councils etc.). As cities grow, smart solutions are essential to handle population density, moving from conceptual ideas to, in some regions, highly connected urban environments. While Western cities often focus on retrofitting existing infrastructure with smart solutions, other regions may focus on new, purpose-built smart developments [120, 134]. Smart Cities make life easier and better for those who live and work there by utilizing technology to enhance urban administration. They reduce their environmental impact by making the best use of natural resources. More precisely, sensors gather information from various urban locations, including hospitals, law enforcement, waste management, traffic, transit systems, and air quality. One of the Smart Cities of Europe is Barcelona. There are many different applications and services for smart city solutions. They can provide safer public areas, more efficient transportation networks, just-in-time waste management, better-balanced and less wasteful water supplies, and efficient building heating and lighting. All of this may sound futuristic, but many of the cities where we live have already adopted some clever solutions, like telemedicine, intelligent traffic signals, ride-hailing, emergency response optimization, and municipal water leak monitoring [188].

Smart systems are being adopted by city planners and authorities at an increasing rate due to the numerous issues posed by rising urbanization rates. Over 60% of the world's energy is consumed in cities, which also produce 70% of its CO2 emissions. Reducing the footprint of big cities is crucial, as most governments have promised to cut national emissions. Another contributing cause is declining air quality, which results in health issues and restricted access to clean water. Perennial traffic and overwhelming trash management have long been serious problems that are getting worse. According to the World Economic Forum, the pace of urbanization worldwide is predicted to increase from 56.2 percent in 2021 to 70 percent by 2050. By that time, an additional 300 million people are predicted to live in cities in China and 400 million in India alone. North America's current high rate of urbanization (83.6%) is expected to rise even further [186]. A smart city is built on the foundation of 5G technology. In contrast to 4G, 5G is ten times faster, has low latency (i.e., there is only a slight delay of 1 to 1,000 milliseconds before a data transfer begins following an instruction), and allows for the connection of millions of devices and sensors within a one-kilometer square area, whereas 4G only allows for a limited number of connections. Various 5G-related technologies are necessary for the development of a sophisticated Smart City. A city, implements several Internet of Things sensors to supervise traffic. Once the data has been collected, it is transmitted across the 5G network. During this process, blockchain technology can facilitate secure data flow. Traffic authorities employ edge computing analytics to assess data in real-time in order to forecast traffic flows and devise feasible congestion management strategies, such as rerouting traffic or altering traffic signal sequences.

Massive quantities of Big Data can be efficiently processed by AI. After that, the dataset is securely stored on a cloud server for future study and utilization

[188]. There are a number of players and aspects involved in bringing smart cities into reality. *In a smart city manufacturer of 4G, 5G, and WIFI* equipment and service providers meet the growing need for dependable high-speed connectivity by sending sensor data over their networks. *High-capacity* telecom towers and data centers that support edge computing are examples of communications infrastructure Agin, manufacturers of semiconductors that provide sensors for data collection Software firms that control devices and sensors and offer intelligent solutions. *In a smart city* business that use cloud storage to store the encrypted data. On the other hand, cybersecurity firms that defend systems against hackers and attacks during the data collection, transport, analysis, and storage process Businesses that offer building management solutions to maximize facility operations, such as waste management, energy, water, and energy consumption. Additionally, the businesses that facilitate the transition to electric cars and smart grids.

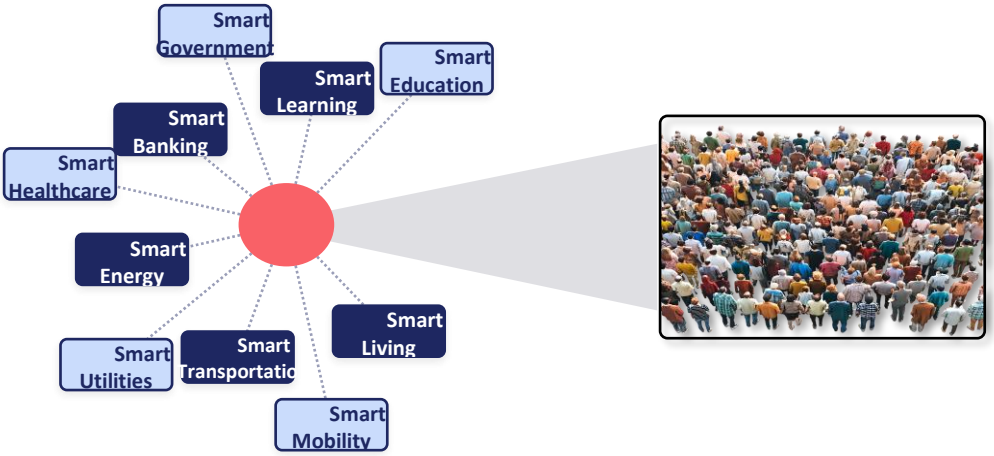

Figure 6: Significance of the Value for People in a Smart City

The interactions between the different disciplines in a smart city offer the greatest potential for value creation. Additionally, services made possible by technology should be mentioned while discussing smart cities. People and their needs are frequently disregarded in this situation. Figure 3 provides a visual representation of the importance of the value of people in a smart city [74]. It is important to keep in mind that a smart city is built for the people, not for its own purpose. It is now necessary to connect disciplines and sectors that did not previously interact closely in a way that adds value. Smart city initiatives are frequently approached solely from a technological standpoint. Nonetheless, it is crucial to address a number of other non-technological factors, including organizational settings, societal culture, and the culture of city management departments (viz. municipalities, corporations, district councils etc.). As cities grow, smart solutions are essential to handle population density, moving from conceptual ideas to, in some regions, highly connected urban environments. While Western cities often focus on retrofitting existing infrastructure with smart solutions, other regions may focus on new, purpose-built smart developments [96]. Smart Cities make life easier and better for those who live and work there by utilizing technology to enhance urban administration. They reduce their environmental impact by making the best use of natural resources. More precisely, sensors gather information from various urban locations, including hospitals, law enforcement, waste management, traffic, transit systems, and air quality.

The information is kept, examined, and applied to real-time problem solving. "Barcelona has been in the forefront of testing the internet of things with a municipal network of 500 km of optical fiber, free WiFi piped via street lighting, and sensors to monitor air quality, parking places, and even rubbish bins," the Financial Times boasts. One of the Smart Cities of Europe is Barcelona. There are many different applications and services for smart city solutions. They can provide safer public areas, more efficient transportation networks, just-in-time waste management, better-balanced and less wasteful water supplies, and efficient building heating and lighting [75]. All of this may sound futuristic, but many of the cities where we live have already adopted some clever solutions, like telemedicine, intelligent traffic signals, ride-hailing, emergency response optimization, and municipal water leak monitoring. Smart systems are being adopted by city planners and authorities at an increasing rate due to the numerous issues posed by rising urbanization rates. Over 60% of the world's energy is consumed in cities, which also produce 70% of its CO2 emissions. Reducing the footprint of big cities is crucial, as most governments have promised to cut national emissions. Another contributing cause is declining air quality, which results in health issues and restricted access to clean water. Perennial traffic and overwhelming trash management have long been serious problems that are getting worse. According to the World Economic Forum, the pace of urbanization worldwide is predicted to increase from 56.2 percent in 2021 to 70 percent by 2050 [186, 187]. By that time, an additional 300 million people are predicted to live in cities in China and 400 million in India alone. North America's current high rate of urbanization (83.6%) is expected to rise even further.

5. Smart Cities and Business in the Era of Advance Technology

A smart city is neither a neutral, self-sufficient benefit nor an objective in and of itself. While a smart city is a place that supports innovation and businesses, reducing environmental impact will also improve the

quality of life for inhabitants and employees. This support comes in the form of a number of services, including: e-Government, which facilitates communication between businesses and the appropriate authorities; efficient transportation, which enables employees to get to work quickly and safely; competitive pricing and performance of telecommunications media for businesses operating abroad; local cloud services, which can foster confidence regarding data security; and a dependable power supply, which is a crucial component of business continuity. At the very least, cheap energy is a competitive factor. Today, software development is a common area where innovation is realized. Information is the starting point for new applications. The software developer will have the chance to incorporate the data into new applications if the city makes it available for free in a machine-readable format. Open Data is the term for this accessibility in urban areas. Other "Open" movements, including open source, open hardware, open content, and open access, share the same objectives as the Open Data movement. Compared to product or process innovation, business model innovation yields higher profits. More than half of executives think that new business models are more advantageous than new products and services, which smart cities use to reach their full potential and take advantage of strategic economic prospects in their future undertakings (University of Sankt Gallen, Competence Centre for Business Models). Nowadays, the majority of sectors acknowledge—sometimes unwittingly—that digitalization creates new business models. We should be persuaded that discussing business models is at least as crucial as discussing projects and business cases, which are the most crucial aspects of developing smart cities. Like an Innovative Triangle, a smart city business model flips the conventional municipal business model on its head.

Despite its recent popularity as an urban planning model in both the theoretical and policy arenas, there is a startling lack of consensus over the definition of the term "smart city." The broad utilization of internet and communications technology (ICT) infrastructure to foster urban growth through improved service delivery, environmentally friendly development, and the building of social capital is frequently referred to as a smart city. Nevertheless, a significant percentage of the literature on smart cities is framed from a single perspective, with a primary emphasis on the technological, environmental, or social components. The governance aspect is neglected, and more comprehensive definitions have just recently emerged. The six attributes Hin and Subramaniam (2012) highlighted were developed by Giffinger et al. (2007) to evaluate the "smartness" of medium-sized cities throughout Europe: people, living, economy, mobility, environment, and governance [149, 150]. Townsend's "smart city" paradigm, which is similarly comprehensive, illustrates the convergence of urbanization with pervasive digital technology. This paradigm is characterized by four key "intelligent" drivers: markets, design and planning, governance, and the commons (Institute for the Future, 2010). This smart city perspective acknowledges the extent to which ICT can impact urban human relationships, as opposed to segmenting the city (the model of six characteristics recalls the heritage of department-led municipal governance). The smart city distinguishes itself from its predecessors by emphasizing the specific tools that will facilitate the resolution of urban issues, such as embedded systems—sensor technologies, cell phones, and smart meters—and big data—vast and complex databases that are employed to analyze urban life [148]. The physical smart city is supported by the following essential ICTs: public interfaces, cloud computing, open data infrastructures, smart personal gadgets, and widespread internet access [151, 186].

Existing Smart City Business Models. Local and national governments, utility companies, ICT firms, non-governmental organizations (NGOs), international organizations, chambers and industry associations, universities, businesses, and citizens are just a few of the many stakeholders in smart cities. Value offers for local clients could therefore be created by each stakeholder (or in groups). Therefore, it is possible to worry that every smart city service or product adheres to or ought to adhere to a modern or creative business strategy. Even in web-based scenarios, modern business models exist, and the city functions as a direct supplier of content and services to its residents and businesses. However, different smart city business models have been described. The Municipality uses smart cities to draw tourists, residents, and investments, even if business models are not meant to be seen in public organization cases (such as Masdar, Gdansk, etc.). Additionally, some of the cases under investigation involve new business models, like the South Korean "city-in-a-box," which is copied in other Asian cases; the Dubai/Malta/Kochi Smart City, which capitalizes on the private investments of the businesses situated in the business parks; and Taipei Eco-city, which refers to a business model for sustainable growth. Representatives from two kinds of modern business models were assigned to these studies: 1. E-service business model [158] and 2. ICT network ownership and commercial enterprise transparency [159]. Every service group was regarded as being provided by a separate provider under the e-service business model (or groups of stakeholders). The network was regarded as the primary resource for the value proposition when a pattern was assigned. In doing so, the network owner provides value to both individuals and businesses. The application of business model patterns in situations where network-related business models were inapplicable is a significant result of this assignment procedure. Broadband, smart, digital, ubiquitous, and eco-cities are the circumstances where the unbundling pattern is most prevalent, and more precisely, in all cases where the smart city has access to and uses essential resources. This is a logical result given that each of these city shapes needs a distinct kind of infrastructure to provide services, such as networks, grids, sensors, etc. The unbundling pattern persists even if these facilities are rented for the provision of services. When the Internet of Things is used as the primary resource, things change, leading to the development of related IoT business models. However, current smart cities across many nations have not yet capitalized on the Internet of Things, leaving room for

start-ups and other suppliers to increase the value of their clients [160].

Smart Cities and Economy. In the era of advance technology, smart cities drive economic growth and development by integrating IoT, AI, ML, big data, robotic, automation and data analytics to improve efficiency and comfort, fostering innovation, and enhancing competitiveness. Which will also create jobs in tech sectors, attract investment, and optimize urban infrastructure like transport, energy, health, finance, industry as well as boosting productivity distinctly and reducing operational costs for businesses. According to the smart city's economic dimension, the concept can be used to boost the urban economy. Specifically, it is anticipated that the smart city will "keep employment and fight against poverty through employment generation, support the innovative economy and wealth of cities" [148]. There is a wealth of research on regional competitive advantage and the traits that, in addition to technological prowess, make places like Silicon Valley more resilient to failure. These traits include a culture of openness between businesses and the institutions in a region and collective innovation [152]. The "presence of a creative class, the quality of and dedicated attention to the urban environment, the level of education, multimodal accessibility, and the use of ICTs for public administration" [153] are all positively correlated with urban wealth. These components, which correspond with the six-part conception of the smart city—smart people, living (lifestyle), economy, mobility, environment, and governance—are viewed as the cornerstone of a new strategic agenda for European cities.

Smart city projects generate employment in IT, engineering, and data management, and attract a skilled workforce. Data-driven, connected environments are highly attractive to corporations, fostering innovation hubs and enhancing local GDP growth. Intelligence agencies and businesses will continue to want services from organizations like "Recorded Future" as the Internet of Things grows in scale and reach and generates even more data. According to Techopedia, the Internet of Things is a "computing concept that describes a future where every day physical items will be connected to the Internet and be able to identify themselves to other devices." In a 2011 report, Cisco describes the explosive growth in the number of internet-connected gadgets in recent years: There were 500 million Internet-connected devices and about 6.3 billion people on the earth in 2003. In 2010, there were 12.5 billion devices linked to the Internet due to the explosive expansion of smartphones and tablet PCs. According to Cisco IBSG, there will be 25 billion Internet-connected devices by 2015 and 50 billion by 2020. Since over half of the world's population currently resides in cities, this trend is expected to continue, meaning that the smart city concept will have an impact on billions of people worldwide. Singapore is expected to become the first smart nation in the world, and India is leading the charge with plans to construct 100 smart cities over the next several years. However, smart cities are not limited to Asia; among the cities participating in IBM's "smarter cities challenge" are Glasgow, Rio de Janeiro, New Orleans, and Cape Town.

6. Prospects in Smart Cities

In the era of advance technology, we may be able to live and work in safer, quicker, and more convenient ways thanks to smart cities. We think long-term, secular growth will benefit the sectors and businesses that can provide Smart City solutions. The Internet of Things (IoT) is a key driver of efficiency and innovation in the age of linked technology and smart cities. However, the essential relevance of cybersecurity cannot be understated given the growth of smart cities and the proliferation of connected devices. In the context of IoT, AI, and smart cities, cybersecurity is crucial, exploring potential threats and defining best practices to protect infrastructure and data. A smart city is an urban model that makes use of technology, human resources, and governance to enhance social inclusion, efficiency, and sustainability—all of which are regarded as objectives for cities of the future [23, 27]. Digital technology is used by smart cities to provide services and gather data. IoT and smart technology integration offers previously unheard-of possibilities for increased productivity, sustainability, and quality of life as smart cities develop. The advantages are numerous, ranging from smart grids improving energy management to connected gadgets optimizing traffic flow. However, new and complex cybersecurity concerns are also made possible by this interconnectedness. The transition to smart cities calls for a thorough reorganization of municipal operations and management, focusing on citizen involvement and public service delivery strategies. Planning, management, and operational procedures must change in order to become a smart city. In order to optimize urban services and identify areas for development, this data can be analyzed [54]. "Smart cities" were conceptualized as a result of the fast use of information and communication technology in global cities [55]. The four elements that Deakin and Al Waer identify as contributing to the definition of a smart city are the territorializing of practices that bring ICT and people together to enhance innovation and knowledge, the integration of ICT into living and working environments, the use of ICT in government systems, and the use of a wide range of electronic and digital technologies [56]. The very aspects that make smart cities intelligent and responsive—such as real-time data interchange and remote-control capabilities—can be misused if they are not appropriately protected [28].

In the era of advance technology, a smart city consists of three layers: an innovation foundation that includes sensors and cell phones connected to rapid communication organizations, apps that turn raw data into knowledge, and use by urban communities and society at large. It is entirely anticipated that the growing popularity of 5G, the widespread adoption of cellphones, and the growing acceptance of IoT will accelerate and elevate smart city developments. This opens up new avenues for creativity to transform urban neighborhoods. The local community has undoubtedly played a significant role in improving inhabitants' well-being as a result of the pandemic. By facilitating diagnosis and treatment as well as preventive self-care, intelligent advancements can reduce the strain on medical services' natural systems. This shifts the focus from medical

treatment that is individual-focused to a local area approach. People and their families can receive medical care that is tailored to them based on information analysis. Given that smart health is a subset of e-health, The Intramuros of the acknowledged smart city is comparable to s-health. In any case, s-health and m-health are distinct from one another. For instance, it is possible that the recognized key correspondence in s-health is not transferable. In practice, it may include dispersed outfoxed sensors in a significant number of cases. In spite of pollution to which the patient is sensitive, the patient receives information or information from an interactive information pole to check the amount of dust and residue. Additionally, the information helps individuals avoid areas that may be dangerous for their medical issues. The information shaft aids in providing the patient with guidance on the most effective path to reach a goal [98]. Therefore, every resident of a smart city greatly benefits from smart healthcare.

Every city's infrastructure serves as its foundation, and development can improve current connections in a variety of ways, such as by implementing green buildings, waste management programs, and traffic regulations. For instance, the goal of Singapore's Green Mark certification scheme is currently to make 80 percent of the city's buildings green. By 2028, according to Gartner, there will be several billion connected IoT devices in business-savvy buildings, driven by broadcast communications systems, 5G, and high-efficiency Wi-Fi in addition to smart utilities like water, garbage, and electricity. Platform assessment frameworks, IoT sensors for wastewater and obstruction detection, stopping sensor applications, lighting sensors, and fire detection frameworks are examples of moving innovations. Future metropolitan areas may become more conservative and close-knit as a result of this [126]. Therefore, every resident of a smart city greatly benefits from smart infrastructure. Mart cities, thus, elevate their tenants' voices. While local area network platforms allow users to collaborate and share resources, applications allow inhabitants to temporarily report local problems. With increased investment and transparency, metropolitan areas are developing into cooperative settings. Metropolitan cities are getting ready to be more human-focused and multidirectional for the government, associations, and inhabitants alike thanks to open information and new advancements [130].

In addition to investing in sustainable energy, cities can employ development to monitor and improve energy use in real time. This involves the use of ethical and sustainable materials, carbon-friendly and resource-efficient strategies, frameworks powered by renewable energy sources, and cutting-edge innovations that adapt to their needs. According to Deloitte Insights, the energy transformation contributes to the construction of a circular economy by decentralizing the production of energy from limitless sources. This is getting ready for urban areas to become energy self-sufficient [163]. Living in a smart city with smart energy is always pleasant and environmentally friendly. With increased use by law enforcement, biometrics, facial recognition, smart cameras, video, and other forms of smart surveillance have all been gaining some traction. These developments help cities look into crime prediction, reduce reaction times, and identify examples and patterns in crime data. However, inhabitants' security, opportunity, and shared freedoms remain of utmost importance, even when new advancements provide enticing options. Urban areas need to exercise caution. in order to investigate the ethical and practical implications of using such technologies, and to avoid repressing specific regions or dividing groups [54]. Therefore, a well-maintained smart safety system may help keep an eye on crime, manage it, and promote peaceful life in smart cities. Urban planning faces a significant challenge in creating intelligent, cost-effective, and resilient urban communities due to environmental change and climatic circumstances. A green urban plan, motivated by decarbonization goals, combines 15-minute city models with reasonable area methods where the majority of daily needs are accessible by bicycle or foot [164].

In the era of advance technology, biodiversity is increased by vertical tiny forests and smart farms for plant development. New and sustainable alternatives, such as floating cities, islands, ranches, schools, and riverbanks, are gaining attention worldwide as ocean levels rise [124, 163]. In order to enable people and other forms of transportation to function in more effective, robust, and maintainable ways, smart mobility uses innovation. Developments in metropolitan portability revolve around improved infrastructure, adaptability as an administration, micro mobility, operational arrangements, and zero-emission transportation. Eco-friendly urban mobility is being made possible by autonomous vehicles, high-level driving, and intelligent traffic management. Innovative vehicle options, including as water taxis, robot axes, and the hyperloop, also find uses in incredibly adaptable cities [113]. In a smart city, smart transportation efficiently empowers all residents. Smart city players are compelled by the e-governance pattern to make their decisions and administrations more transparent, palatable, collaborative, and uncomplicated. Blockchain and IoT-based agreements are used by startups to do this, keeping track of all partners for the dynamic exchange. Advanced visas, web-based voting, and robust information security tools are examples of computerized administrations that encourage resident collaboration and contribute to the growth of e-majority rule government. Additionally, local e-profession centers, online retraining programs, and digitalization of corporate functions like burden filing and permitting contribute to financial growth and an innovative business environment [161]. In a smart city, e-governance guarantees citizens' satisfaction, accountability, and openness. Waste production rises in tandem with the continuous development of metropolitan populations and purchasing culture. IoT sensors are used by sophisticated and intelligent waste management systems to accurately track waste pickup, provide residents with usage advice, and incentivize them with financial benefits. Reusing e-waste also allows people to exchange equipment for cash. Smart containers manage the quantity of waste and sort uncategorized rubbish [115]. By avoiding human interaction, artificial intelligence recycling robots precisely identify the types of

materials during waste sorting, increasing total productivity and large efficiency. When combined, emerging waste management strategies lessen the impact of economic activity on the environment [162]. Effective trash management keeps the city clean and healthy for its residents.

7. Divergent Aspect of Smart City Development

With its early adoption of a sustainable, environmentally friendly agenda and emphasis on public transportation and urban infrastructure, Europe has long led the way in Smart City projects, despite having many old cities with legacy infrastructure systems in the era of advance technology. Intramodality, which combines several public transportation options into a seamless travel experience, has been a priority of European transport policy, according to 2018 McKinsey research. Rapid technical advancement has also fueled electronic services like ticketing systems. One characteristic of Smart Cities in the West is that development is primarily bottom-up, with individuals and the private sector actively involved in creating projects to enhance quality of life, promote economic growth, and protect the environment. In 2018, for example, the federal government of Canada invited about 200 communities nationwide to enter a competition wherein technological advancements may be used to improve people's quality of life. In order to identify demands and give city officials a plan for creating future traffic and public transportation infrastructure, the Intelligent Cities program held resident workshops. There must be a cultural change in the way cities are run and controlled in addition to the participation and input of local residents [15]. Additionally, municipal technology platforms must be more accessible and not kept in disconnected "silos" that are unable to work together. More than 40 local departments were operating on disparate, disjointed technology platforms when Los Angeles Mayor Eric Garcetti investigated the implementation of Smart City solutions.

In order to compile approximately 500 datasets from the city's departments as well as those from the county, state, and federal governments, Geo Hub was established in 2016. Los Angeles was able to manage resources and make better decisions thanks to the information that GeoHub uncovered about the city's infrastructure and public safety needs. A number of silo-type models were dismantled in Barcelona, including those in which networks lacked communication, users were bound by rigid contracts, or service delivery was contracted out to big operators with no government control over the collection or use of resident data. Since then, the government has taken over accountability for such data in order to protect privacy. With an emphasis on small, local businesses, the procurement of services was also made transparent. In the meantime, Asia has seen a boom in Smart City initiatives in recent years. The creation of smart cities is typically top-down in nations with powerful central governments, like China or Singapore, where the government creates rules and allocates funds. Usually, the emphasis is on enhancing urban governing capabilities and expanding infrastructure. Smart Cities are highly developed areas where many services are owned by the public sector. These areas include waste management, water, power, transportation, and telecommunications. A fully functional Smart City must have this smooth data and technology flow [175]. Large heritage Western cities might need a few years to get to this level of Smart City development. However, there is a need for improvement, and both in the East and the West, more clever ideas are probably in store.

In Chicago, infrastructure investment, economic development, and community involvement are the three primary application areas for open data and smart city initiatives. To achieve gigabit speed over an open network, the city is investing in a new open fiber-optic ring. The city intends to support a more vibrant and competitive marketplace by making investments in open infrastructure. The city expects that reasonable pricing and high-speed broadband would entice digital technology enterprises to establish or relocate in Chicago. The unlicensed radio spectrum in Chicago City is exhausted. It is currently collaborating with the Federal Communications Commission on spectrum to dynamically share spectrum allotted for public safety so that it can be utilized for cell phones, tiny cells, etc. when not in use. The goal of the Smart Chicago Sustainable Broadband Adoption program is to promote economic growth in five underprivileged Chicago areas. More than 11,000 residents, 500 small enterprises, and nonprofit organizations can get computers and training opportunities through the broadband awareness and adoption program. Since companies and applications are developed on their open data platforms, Chicago sees an economic growth justification for data accessibility. [172. One of Chicago's top priorities is facilitating a market of interested parties and coordinating the demands of the public, business, and community sectors. In order to boost the diversity of the Chicago technology industry workforce, the mayor gathered a group of specialists known as the Technology Diversity Council to create policy suggestions. It could be necessary to work with other departments on some recommendations. The Smart Chicago Collaborative is responsible for a large portion of Chicago's community engagement efforts [173]. Chicago's investment in smart cities has been measured using a mixed-method approach. Cost savings are a major indicator for the city. For instance, by switching to cloud-based productivity tools, the city was able to save $400,000. In a similar vein, the WindyGrid application aims to reduce costs by providing information about how the city runs in order to facilitate more effective city operations and guide long-term policy decisions. However, measuring this is a major problem for Chicago.

Singapore has created and implemented some of the most cutting-edge urban solutions in the world, ranging from energy management and water treatment to public housing and transportation. The city has successfully transformed the difficulties of urban development into lucrative business opportunities because to progressive leadership and a strong dedication to sustainable development. Other cities have successfully implemented and duplicated some of those solutions. Singapore is already considered a "smart" city, but the government is constantly looking for ways to make it

smarter. The focus on "life-ability," or building a city where people are glad to live, the integration of policies, and the wise use of ICT are important components of this strategy. Singapore is a highly developed nation that depends on advanced technology, a highly skilled labor force, high productivity, and sound economic policies implemented by the government. Its emphasis is on innovation as a growth driver, much like the Netherlands. Thus, it makes significant R&D investments. The foundation of Singapore's development over the past few decades has been the attraction of foreign direct investment [186]. The Economic Development Board (EDB), which oversees foreign direct investment, offers incentive schemes to entice businesses in particular industries. Businesses with significant R&D expenditures, advanced technology, and high productivity are of primary interest to the EDB. Foreign design and architecture also pique Singapore's curiosity. Singapore is constantly searching for talent [174]. To draw gifted students and academics from the area and beyond, it offers unique programs.

In the era of advance technology smart cities are rapidly evolving concept-transforming urban developments. Smart cities use advanced technologies and data analytics to improve the quality of life for their citizens, increase the efficiency of infrastructure and services, and promote sustainable economic growth. The Sustainability Magazine ranking reveals the best integral technology and sustainability strategies after assessing their housing constraints and identifying their key business partners [178]. In the report it has been evaluated that Helsinki of Finland occupies the top spot for its citizen-focused approach and its digital project Helsinki 3D+, in collaboration with Nokia. Dubai of UAE follows, an example of technological ambition with its Core42 autonomous taxis and AI-based applications as its private sector ally, although more than 40% of its residential properties are owned by non-residents. And Seoul of South Korea, which combines connectivity and smart transportation (Samsung SDS), despite a gap between central and peripheral prices, forcing the displacement of the younger population. However, London of UK with Arup serving as the company in its joint venture, prioritizing open data, AI, and social participation with the support of digital infrastructure, while facing traffic congestion and high prices. Ahead of New York of USA (IBM) for wireless management, is Tokyo of Japan (Hitachi) for its capacity to detect and react to natural disasters, Copenhagen of Denmark (Siemens) for its public transport, Amsterdam of Netherlands (Philips) for energy efficiency, Singapore (ST Engineering) for its urban mobility, and Barcelona of Spain (Cisco) for its high level of digital democracy.

8. Challenges in Smart Cities

AI creates prospects for more intelligent healthcare through the development of smart cities. Concurrently, the collection and exchange of information is necessary for these developments. Information sharing is often hampered by security concerns. However, the topics that come up most frequently when discussing the limits of incorporating progress into medical services are security and protection. There are three types of privacy-ensuring information withdrawal mechanisms being investigated that could provide residents of smart cities with confirmation. First, by making the information difficult to understand, it can be "camouflaged" while being collected. Second, ensuring the information's obscurity is a goal of protection-saving information mining in cases where the initially collected data will be sent to external parties [86]. This is a validation that certain arbitrary customers' identifiable attributes are identical to those of essentially k-1 different clients. Strategies such as removing mild attributes, increasing the range of touchy traits, or introducing fake information to confuse the honest qualities are some ways to achieve K-anonymity [171]. allowing sensitive information to be "concealed in the group." Due to multifunctional information, changing identifiers periodically is an alternative to downgrading a single, consistent identification for each client. Long-term and spatial client tracking becomes challenging as a result of this shift. When a client enters a space with k-1 other clients, it's the perfect time to alter the identification. Thus, it won't be possible to rapidly connect old and new IDs. Third, the outcome of information mining computations can be modified to prevent sensitive data from leaking. Once more, a gathering calculation's reasonability can be sufficiently reduced to fulfill execution constraints while limiting the risk of being used to identify individuals. Regardless of the combination of approaches used, it is crucial that all parties involved—city planners, strategy developers, and tech providers—agree on security measures and illustrate to city residents the potentially sensitive information sharing that could occur with smart city developments [164].

Both usability and accessibility A common theme in smart city initiatives is healthcare. However, the cost currently stands in the way of the inevitable adoption of advancements that can be used at the municipal and individual level. Long-term cost savings for the city and its residents can be achieved by incorporating technology into large medical care. In any case, the cost of the real development may prevent networks from adopting the innovation for a while [87]. There are several ways that smart cities make use of information and communications technologies. The goal of smart city platforms is to develop appropriate and play smart objects that can be delivered anywhere and blend in with their surroundings. Along with design observation, climate observation, security, and intelligent transportation, the things should aid in assessing well-being [20]. A Smart City needs "shrewd" citizens who actively participate in and effectively navigate new developments if it is to actually exist and thrive. Redetection of the smart city paradigm should be a part of the execution cycle of any new, comprehensive technology project. ember highlighting the advantages of the local area. This should be possible through a series of in-person civil focus-style gatherings, email campaigns to recruit voters, and an online preparation phase that stays up to date with the latest election results. Local communities are more willing to take advantage of developments and encourage others to do the same when they wish to influence the alternatives that affect daily life and are being

passed on in a clever and pragmatic way. This is essential to the success of a Smart City [21]. Notwithstanding the wealthy and technologically advanced, it is crucial that Smart City orchestration incorporates the prospect, all else being equal. Development should always aim to bring people together rather than further dividing them based on factors like income or educational attainment [22]. Examining these networks in relation to the various topics covered in this article will improve the overall result of a solution outside the domain of knowledgeable clients [24, 25].

Smart cities integrate multiple domains, including transportation, energy, health, education, agriculture, business, social, banking, economy and governance, to create an interconnected and intelligent urban environment. The integration of smart technology and data-driven solutions in smart cities has all potential to revolutionize urban living by providing citizens with personalized and accessible services. However, the implementation also presents challenges, including data privacy concerns, unequal access to technology, and the need for collaboration across private, public, and government sectors [177]. Even though technology has a lot of appeal, becoming a Smart City will not be easy. Because it's simpler to start from a relatively fresh slate than to upgrade outdated infrastructures, legacy cities face considerable challenges. In this sense, newer cities in Asia and the Middle East have a clear advantage. Another encumbrance that can make the adoption of some clever solutions more difficult is very big populations. New technologies can be adopted more quickly in smaller cities like Zurich (400,000) or Helsinki (1.3 million). In the 2020 IMD Smart City Index, they came in second and third place worldwide, respectively. The following are examples of typical points of vulnerability:

- **Data breaches and privacy issues:** Cybercriminals are drawn to the enormous volumes of data produced by IoT devices or AI systems. Individual privacy is seriously threatened by unauthorized access to sensitive data, which can result in identity theft or other nefarious actions [29].
- **Infrastructure Vulnerabilities:** Public services, electricity grids, and transportation networks are all susceptible to cyberattacks. The functioning of cities and public safety may be significantly impacted by disruptions in these vital services [50].
- **Device Manipulation:** Malicious acts, such interfering with communication networks or changing data, can be carried out by compromised IoT devices or AI systems. The dependability and integrity of smart city operations are at stake as a result [51].
- **Denial of Service (DoS) Attacks:** Critical services can be interrupted by flooding systems with so much traffic that they fail. This may result in grid outages, traffic jams, or compromised emergency response systems in the context of smart cities [52].
- **Risks of Surveillance Systems:** Smart cities and security technologies coexist. However, having inexperienced staff and ineffective processes can be risky and lead to cyberattacks even with the strongest technology defenses. In the event of a cyberattack, security and emergency alarm systems are the most vulnerable and might have the most effects**.**
- **Device Hijack:** Because a smart city's infrastructure is made up of millions of devices, attackers often try to take over a device in order to obtain control. Because the item has continued to function as intended, users might not be aware that someone has taken control of it. Once in control, a hacker can take advantage of other networked devices. For example, they might utilize smart meters to steal electricity from a municipality or employ ransomware to threaten a city's energy management system [146].

Deakin defines a smart city as one that utilizes ICT to meet the needs of the market (i.e., city people) through community participation [57]. As an alternative to broad notions that are difficult to define, investigations of smart city projects could be employed to elucidate the concept of smart cities [58]. Data is collected from individuals, devices, structures, or cameras. Smart cities are employed in a variety of applications, including traffic and transportation systems, power plants, utilities, urban forestry, water supply networks, trash disposal, criminal investigations, information systems, schools, libraries, hospitals, and other community services [30]. The cornerstone of a smart city is the integration of people, technology, and processes, which connect and interact across industries such as infrastructure, healthcare, transportation, and education [31]. The monitoring, analysis, planning, and governing procedures of their local governments are the defining characteristics of smart cities. In a smart city, the interchange of data involves businesses, people, and other parties who stand to benefit from its utilization [32]. Outdoor lighting, public transportation, and visual surveillance were the three primary sources of expenditures associated with smart cities as of 2022 [34]. In order to optimize city services and foster a relationship with their residents, smart cities integrate ICT (information and communication technologies) and IOT-connected devices [35]. ICT has the potential to enhance the quality, performance, and interactivity of urban services, as well as to reduce resource consumption and costs, and to enhance communication between the public and the government. Smart city applications regulate urban flows and facilitate real-time responses [36].

Figure 7: Proper guidance [125] and developing relation is the prime task of future leaders [126]

Compared to a city that has a traditional "transactional" relationship with its residents, a smart city might be more equipped to handle difficulties. However, there are numerous ways to interpret the phrase [35]. Smart city technology has already been used in a number of cities. Initiatives for smart cities have drawn criticism for being corporate-driven [37], poorly tailored to the requirements of locals [39], generally unsuccessful, and a step toward totalitarian surveillance [40]. Cybersecurity must be a key factor in the transition to smarter and more connected urban environments [26]. Although there are many advantages to IoT and smart cities, there is also a duty to protect inhabitants' safety, privacy, and general well-being [41]. Smart cities can create a secure foundation for the future and one where innovation and resilience go hand in hand by implementing preventive measures, adopting strong cybersecurity practices, and cultivating a culture of awareness. This will guarantee a connected urban landscape that is not only intelligent but also safe and reliable [46]. IoT, AI, and smart city cybersecurity best practices:

- **Encryption and Secure Communication:** Use strong encryption techniques to protect information sent between networks and devices. This guarantees that the information is kept private even in the event that it is intercepted [42].
- **Regular Software Updates and Patch Management:** Update IoT systems and devices with the most recent security fixes. Frequent software updates aid in patching security holes that hackers might exploit [43].
- **Network Segmentation:** To reduce the possible consequences of a security breach, isolate important systems and network parts. By doing this, vital portions of smart city infrastructure are shielded from unwanted access [44].
- **Authentication and Access Control:** Put in place robust authentication procedures to confirm users' and devices' identities. Strict access restrictions should be implemented to guarantee that only authorized users can communicate with IoT systems. [45].
- **Security by Design:** From the beginning of IoT devices and smart city initiatives, integrate cybersecurity measures. Instead of being an add-on, security should be a crucial component of the design and development process [47].
- **Incident Response and Recovery Plans:** Create thorough incident response plans to quickly handle cybersecurity issues. A clear plan in place speeds up recovery efforts and lessens the impact of a security incident [48,59].
- **Public Awareness and Education:** Inform stakeholders and the general public on the significance of cybersecurity in smart cities. To enable people to defend themselves and support citywide security, cultivate a culture of cyber awareness [49, 53].

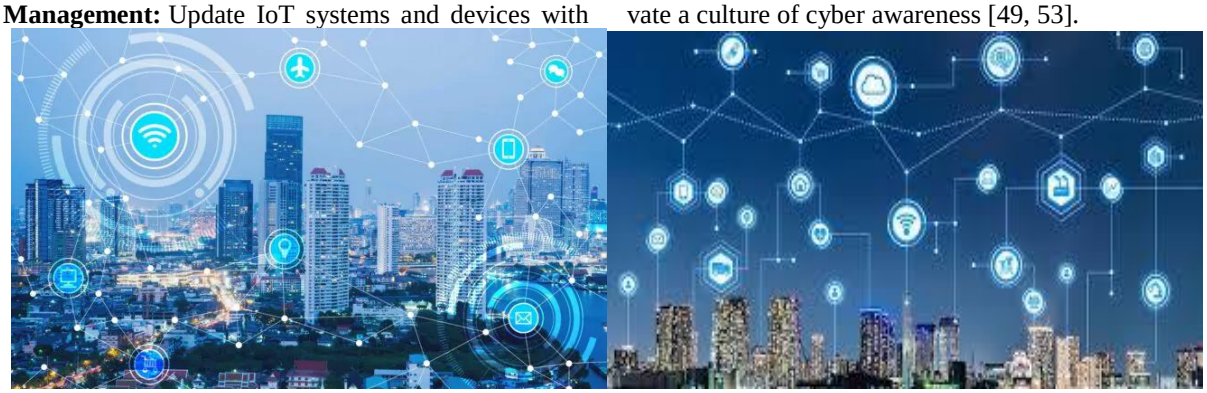

Figure 8: Use of smart technology and smart city in global perspective [60, 61]

9. Legal and Ethical Challenges Related to Use of Digital and Smart Technology

In the era of advance technology one of the major problems caused by the fragmentation of regulations on a regional level is the global Internet of Things ecosystem. Lack of global data policy uniformity makes it difficult to deploy IoT solutions efficiently in every jurisdiction. For example, GDPR outlines strict cross-border data transfer laws that are not covered by CCPA. Regional regulations, such as India's DPDP, place additional limits on global scalability due to their focus on data localization; frameworks, such as the Privacy Act of Australia and the PDPA of Singapore, need to be flexible enough to accommodate the rapid evolution of the Internet of Things (IoT) sector. Data protection policies around the world need to be standardized to address these issues. Unified standards that strike a bal-

ance between privacy, security, and innovation can facilitate international cooperation, lower costs, and simplify compliance. By conforming to these new standards, internet of things (IoT) developers can build AI and IoT systems that are user-friendly, secure, and scalable on a global scale [131]. Unauthorized access to tracking devices is a major security concern in the Internet of Things ecosystem because hackers can take control of equipment that are specifically designed to monitor and acquire sensitive data. Several techniques exist for executing such attacks, such as evading security measures, using stolen or compromised credentials, or exploiting firmware vulnerabilities. Most users' privacy may be violated if attackers gained unauthorized access and changed the data being received, disabled the tracking device, or listened in on users' actions. Because hackers can get knowledge about users' habits, health data stream, preferences, and behavioral patterns with just one infiltration, this is a worrying situation for home digital twins. Improper handling of such data could lead to fraud, identity theft, or even worse, physical invasion, including the theft of a user's house or vehicle. Cyberattacks on AI and IoT are on the rise, and the more sophisticated these attacks are, the more they target specific aspects of human lifestyle, such as homes, wearable technology (home space), or vehicle type [132].

Although Bluetooth beacons improve data anonymization, they are not always secure and can be abused. Additionally, wireless connection tracking offers relatively little protection against cybercriminal activity and is highly vulnerable to privacy invasion and misuse. Biometric sensors have better data anonymization than other technologies, but they can raise privacy concerns despite being useful for identification. These monitoring techniques demonstrate that the performance and level of dangers in IoT systems vary, therefore it is necessary to consider tracking in light of privacy and security concerns. Once more, the widespread presence of IoT devices—the majority of which lack robust security measures—contributes to the ongoing issue of illegal access. It is also more difficult to guarantee consistent protection because of the differences in security methods between manufacturers and devices. Furthermore, consumers usually neglect to change the default security settings or update the software on their devices, leaving them vulnerable to attack. Attackers may occasionally utilize password-protected or password-free devices to listen in on data as it is being transmitted, and if the encryption technique is inadequate or nonexistent, they may be able to retrieve important data [133]. The Home Digital Twin system's trust and privacy are also jeopardized by tracking devices' illegal access. Smart thermostats, security cameras, alarms, and other devices that monitor and regulate vital operations could be tampered with to cause havoc in a home. This would occur if hackers took over security systems, altered environmental controls, or sent malicious commands to other devices that were connected, causing the system to malfunction and possibly turn malevolent. This emphasizes how crucial it is to have thorough privacy and security measures in place to stop unwanted access, which will only increase as IoT devices become more integrated into daily life in the era of advance technology [134, 187].

False data injection attacks over tracking devices in IoT systems could compromise the entire Home Digital Twin ecosystem's integrity and reliability [135]. Attackers intentionally inject false or misleading information into the system to taint the tracked and sent data of IoT devices. Instead of powering down the devices, we can alter the data they receive or share in order to influence the system's decision-making or behavior in hostile environments. The impact of fake data injection attacks can range from minor disturbances to complete system crashes, depending on the data's intended use and the significance of the decisions dependent on it. One common method for injecting misleading data is intercepting and modifying the communications between the Internet of Things (IoT) devices and the control system or cloud platform. One example could be an Internet of Things (IoT) gadget for smart homes that records data on environmental monitoring, such as energy use, humidity, and temperature. It is possible for an attacker to inject the system with bogus data, leading it to incorrectly define normal ranges for environmental circumstances [136]. For example, if no one is home, it's possible to fool a thermostat into thinking the house is hotter than it actually is by directing the heat to different areas or floors. At their worst, these might create catastrophic failures, like home systems breaking down, or even more dangerous safety risks, such a data breach that triggers false fire alarms. Redundancy and cross-checking by many devices are also critical safeguards against bogus data injection [137]. In addition to finding discrepancies between different sensors or devices tracking the same data, this system has the ability to identify outliers as potentially fabricated data [138]. When multiple smart thermostats in a building detect an anomalous temperature difference, for instance, they can coordinate an inspection to confirm the data's accuracy. Particularly in fields like security and health monitoring systems, where data manipulation is possible, having similar data from many sensors can help detect these incorrect attempts to enter false data [139]. Last but not least, machine learning algorithms can be used to identify these suspicious patterns of fake data injection. These models are able to learn normal behavior by rapidly identifying unusual (irregular) data values that deviate from the expected pattern. Historical device data might further improve the models by illuminating patterns that can indicate data manipulation and offering a broad comprehension of typical device usage in the era of advance technology [188].

In the era of advance technology data protection, accountability, and the secure implementation of autonomous systems are the main concerns of legal frameworks. Future legislation is influenced by ethical considerations, which frequently come before formal regulation. Concerns of widespread surveillance and the degradation of individual privacy in areas that are customarily regarded as private are raised by the continuous monitoring capabilities of smart devices such as wearable health monitors, smart home sensors, and security cameras. As is well known, AI systems and Internet of Things devices learn from data and networks,

which can carry ingrained societal prejudices. This can result in biased outcomes in fields like law enforcement, recruiting, and finance. To guarantee justice and equal treatment for all demographic groups, it is morally necessary to recognize and address these biases. However, a loss of human control and a decline in critical thinking abilities might result from an over-reliance on automation, IoT devices, and AI or ML-driven decision-making. According to ethical design principles, systems should encourage digital literacy, prioritize user interaction, and permit manual overrides. Furthermore, there is an ethical worry that some groups of people may not be able to profit from smart technology because of their location, socioeconomic level, or lack of digital proficiency, which could exacerbate already-existing social disparities. Once more, the opaque nature of many AI algorithms makes it challenging to comprehend the decision-making process, undermining openness and confidence. Clear disclosure on data collection and use is essential for ethical practice in order to foster user trust and accountability.

10. Legal and Ethical Issues for Developing Countries

The responsible adoption of IoT and AI-powered smart homes is greatly influenced by the legal and regulatory environment, especially in developing countries like Bangladesh and any burgeoning digital economy. We require some kind of digital or smart economy policy and strategy, which should offer a thorough framework that guarantees and strikes a balance between innovation and the defense of individual rights. This calls for vigorous and appropriate regulation, regulatory sandpiles, and robust institutional cooperation. Ethical IoT, AI, data governance, and cybersecurity must be given top priority in the policy in order to guarantee that smart home technologies function in a setting that respects human rights and is people-centered [4, 187]. by giving regulatory organizations like the national cybersecurity authority and the national data protection commission/authority more jurisdiction. They should be in charge of the seamless digital transformation of pertinent smart technology use sectors and must promote public awareness and stakeholder participation. In addition to supporting equitable growth, digital literacy, personal safety, data/digital security, and the development of a strong, meaningful, and sustainable digital or smart economy, such a holistic strategy is in line with worldwide best practices [7]. IoT, AI, data protection, and cybersecurity laws must be sensible and well-balanced in order to address the intricate relationship between innovation and each person's right to use the internet. Transparency, equity, and accountability are among the values outlined in the UNESCO guideline on the ethics of IoT and AI [5, 188]. Once more, because of the speed at which technology is developing, there will be challenges in the future in regulating and using IoT and AI-powered smart appliances. Therefore, it is necessary to make adjustments and ongoing revisions to the regulations, as well as strike a balance between the risk of strangling innovation and aggressive regulations in the era of advance technology.

in the era of advance technology, the quick development of smart technology raises a number of ethical and legal issues. Data protection and privacy are two of the main issues. Lawyers must manage the ethical responsibilities of protecting client confidentiality and preserving the privacy of sensitive information when technology gathers and analyzes enormous volumes of personal data. The possibility of bias and discrimination in technology-driven decision-making processes, such as algorithms used in legal research or IoT, AI, and ML employed in predictive analysis, is another matter of concern. Legal practitioners need to make sure that these technologies don't reinforce unfair prejudices or provide unfair results. Additionally, concerns including cybersecurity, the unlicensed practice of law via internet platforms, and the moral use of social media by attorneys are also relevant. Legal professionals need to keep up with technological developments, create ethical standards, and strike a balance between using technology for its advantages and adhering to ethical and professional requirements [140]. Legal practitioners need to increase awareness and educate themselves on a constant basis. It is essential to keep up with technology developments and comprehend their ramifications. In a technologically advanced society, maintaining competency and ethical standards requires active participation in continuing education and training. It is crucial to create and adopt best practices and ethical standards tailored to smart technologies. In order to create thorough ethical frameworks, professional associations and governing bodies are essential. These frameworks ought to address issues like cybersecurity, privacy, data protection, bias reduction, and ethical social media use that are brought on by smart technology [141, 187]. In order to resolve complex legal or ethical crises or challenges in the near future, technology specialists and legal professionals must collaborate in the twenty-first century.

Artificial intelligence, machine learning, data science, robotics, and other cutting-edge technologies are continuously changing and influencing our lives. Our lives are improved by the new breakthroughs and developments brought about by new technology. We can now accomplish tasks more quickly, more effectively, and in ways we never could have previously thanks to new technology that keeps pushing the envelope. Whether it is in transit or at rest, we must make sure that all sensitive data is encrypted. To make sure AI systems and IoT devices are operating accurately and morally, we must schedule routine audits. Our staff needs to receive frequent training on ethical AI use and the most recent cybersecurity best practices. Interdisciplinary communication and teamwork are essential. Experts in technology, artificial intelligence, data science, and cybersecurity should interact with legal professionals. This cooperative strategy guarantees a thorough grasp of the ethical ramifications associated with evolving technology, encourages creativity, and encourages accountability. It is now a constant process for regulatory frameworks to change in tandem with technology improvements [142, 186]. Legal professionals and technology stakeholders should be actively involved in the creation and revision of laws and regulations by governments and policymakers. These policies successfully handle ethical issues like data governance,

privacy protection, and algorithmic decision-making responsibility. Future legal issues and the environment will be more technologically advanced and complex in the era of advance technology.

In the era of advance technology, it is essential for policy maker of developing nations considering critically to develop policies that promote lifelong learning and continuous smart skill development, ensuring that the workforce remains agile and adaptable to the rapidly changing demands of smart cities. These could include offering incentives for businesses to invest in the ongoing education of their employees or implementing urban development plans that seamlessly integrate technology and learning spaces into the city landscape [183]. So, effective strategies like investing in employee training programs, promoting cross-departmental projects, facilitating mentorship and knowledge-sharing sessions to develop smart skill for citizen is very important. For all stakeholders including citizen of smart city, relevant study emphasizes the importance of digital engagement and smart technology friendly approach as a key driver of skill development. Therefore, it is imperative to ensure digital and smart technology inclusivity and literacy, guaranteeing that all citizens, regardless of age or background, have access to the digital and smart resources and training necessary to flourish in a smart city environment [184]. Additionally, developing and accessing specific policy and educational involvements need to be inform stakeholders in creating effective programs for lifelong learning of smart skill development across diverse demographics and career stages in smart city environments in 21st century [185, 188].

11. Conclusion

In the era of advance technology, we live in a time of intelligent technology. By 2030, AI is expected to require the transformation of about 75 million to 375 million jobs globally, according to forecasts by MGI Research. In addition, the MGI study emphasizes the establishment of new roles and duties. The American Economic Association's researchers agree with the MGI's predictions, stating that only a few jobs can be fully mechanized, even though some tasks can be automated. The world is now more interconnected and operates as part of a global financial and economic ecosystem. The 2008 financial crisis severely damaged the economies of developing and least developed countries, causing economic contraction, social and political unrest, and a general decline in the standard of living for the general populace. It is clear that any setback on one side of the globe would have an impact on the entire global economy. The world is waiting for the same financial crisis. Along with digital and smart technologies like IoT, AI, ML, DL, big data, blockchain, etc., organizations that have emerged in this period have grown increasingly complex in the areas of information and communication. People's interpersonal relationships, communication styles, professional lives, and skill sets have all changed as a result of this circumstance. According to Warren Buffett, intelligent technology—especially artificial intelligence—is profound, but it also poses serious threats and ethical dilemmas that are comparable to the development of nuclear weapons. He emphasizes that the development and application of technology must have a purpose and that moral principles like accountability and integrity cannot be compromised. One of the most basic factors that improved openness and transparency, according to Mark Zuckerberg, is the growing emphasis on developing deeper social interactions, better connections, and trustworthiness. We are transitioning from a transaction-focused world to a relationship-focused one. Rapid urbanization in the twenty-first century has presented benefits as well as challenges. The complicated demands of urban life have led to the emergence of smart cities as creative solutions. The foundation of this change is ICT, which integrates public services, infrastructure, and environmental sustainability. While AI, ML, robots, IoT, and big data improve urban planning, optimize resource usage, and fortify governance, the computing continuum has emerged as a crucial paradigm for effective resource management within ICT.

In the era of advance technology natural resources and energy, transportation and mobility, infrastructures, governance, economics, and humans are the six core areas and associated sub-domains of smart city sending. To understand the relationship between various geological, urban, demographic, human resources, ecological, and innovation-related aspects, a dataset of logical factors has been compiled, and deterioration analyses have been guided. In reality, there isn't a single, globally recognized definition of smart cities, and the most recent developments and examples of smart city development typically depend on neighborhood setting variables. In this way, city strategy developers are urged to try to understand these factors in order to develop appropriate methods for their smart cities. The concept of smart cities has recently gained a lot of attention and will likely continue to do so in the future. Smart plans are being distributed by urban communities, related events are relocating, and that's just the beginning—more books on the subject are being written. Smart innovations can help metropolitan communities manage traffic streams, reduce the use of fossil fuels in products, and set aside money. However, the plan's complexity is impeding its advancement. There are many different stakeholders involved, such as local experts, citizens, innovation groups, academics, etc., and each has a different idea of what a smart city should be. Most of the conversation is stymied by trying to understand what "smart" means rather than how it can help urban communities achieve their goals.

In the era of advance technology, the importance of personal accountability and moral judgment must be emphasized by those working in the legal field. They should think about the moral consequences of technological use. Experts in the field should be mindful of their own prejudices and ethical issues while making decisions that put their customers' needs, the rule of law, and justice first. Legal professionals can successfully traverse the junction of technology and legal ethics by embracing these techniques. In a world when everything is becoming digital, it protects basic ethical values, promotes fairness, and guarantees professional integrity. The collection, processing, and storage of personal data are areas where technological decisions

significantly affect privacy regulations. Using AI and IoT devices raises questions about consent and data ownership. Privacy laws like the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA) set standards for data protection, but technological advancements often outpace legal developments. Privacy laws need to be flexible yet robust to address the dynamic nature of technological innovation. As a legal professional, staying informed about these changes is crucial. Consider a tech company developing a new IoT device. They must ensure that their product complies with current privacy laws and anticipate future regulations. Develop transparent data usage policies that clearly explain how data is collected and used. Keep abreast of changes in privacy laws and update your practices accordingly. Educate users about their rights and how their data is used. As legal professionals navigate this complex terrain, they must strike a delicate balance between embracing technological advancements for the benefit of their clients and ensuring adherence to ethical principles that safeguard the integrity of the legal system. To navigate the intersection of law and emerging smart technologies, from AI governance, extensive use of ML/robotic and cybersecurity regulations to blockchain compliance is demand for contemporary era. From relevant law courses need to be arrange and that can be useful to gain practical insights to handle future challenges. Such courses are now found on YouTube, Udemy, edX and other social media which covering GDPR, EU AI Act, software liability, and digital privacy frameworks, cyber security issues for legal professionals and tech leaders. We need to explore and introduce more purposeful law and ethical courses to handle future challenges related to the consequences of extensive use of smart technology. Smart city technologies promote a "green economy," contributing to sustainable development while improving quality of life and attracting talent. A smart economy relies on high-speed communication infrastructure and automation, IoT, AI, ML, robotic, and the digitization of services to enhance competitiveness and foster collaboration between citizens, universities, and businesses. This market is expanding very rapidly.

In the era of advance technology, he IoT, computing continuum, big data, Ai, ML, etc. are converging in the 21st century, making smart cities a reality. Data localization, scalability, and responsiveness are handled via the computing continuum (edge-fog-cloud-HPC). These days, "smart cities" are touted as the way to handle city issues like pollution, trash, and overcrowding. When discussing the company strategy, nevertheless, these ideals do not emerge as obvious. Particularly, whether it's through increased internal efficiency (web-based models), financial gain (network providers), enhanced city appeal (e-commerce models), or uniformity, all of the studied business models seem to benefit smart city owners (value integrators). Lastly, IoT is still in its early stages of development and has not been included in smart city applications, despite the fact that it is a hot topic and creative goods and services are being created in tandem with it. Both the smart city sector and state and regional governments have a vested stake in these results. Currently, there is debate on the vendor-imposed technological push, even as smart city development is on the rise. Sustainable, citizen-centric, and real-time urban services are made possible by the incorporation of new paradigms into smart cities. To tackle issues of digital inequality, ethics, and privacy, policies and e-governance will need to change in tandem with technology. However, holistic integration of advanced technology and data-driven methodologies, are not merely altering the architectural landscape but fundamentally reshaping the societal fabric, economic operations, and life's quotidian beats, mainly within the ambit of growing markets. In 21st century this rapidly metamorphosing urban environment, the pivotal role of human capital, especially the acquisition and application of smart and advanced skills, is increasingly pronounced. These competencies, summarizing a diverse spectrum of skills including and that not limited to critical thinking, creativity, collaborative prowess, and digital literacy, are deemed essential for individuals to navigate and excel amidst the ongoing flux of urban transformation and technological progression. The acquisition and refinement of these smart skills are instrumental in fostering a workforce that is not only adaptable but also adept at driving innovation and productivity within the smart city ecosystem.

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