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Transformation of Consumer Behavior Through Smart City Technology: A Literature Review

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Abstract

Once city implements a smart city, the transformation that occurs not only impacts the city's infrastructure and operations, but also significantly influences individual interactions with public facilities and their consumption patterns. This literature review aims to identify changes in consumer behavior and daily activities after the implementation of smart city technology. The methodology used is PRISMA, with references published over the last decade. The research results show changes in various aspects, including mobility, energy efficiency, citizen engagement, environmental awareness, shopping experience, quality of life, education and information, business prospects, and response to the crisis. These findings show that smart city technology brings positive changes in the daily lives of city residents, which are influenced by the use of technology and the way it is implemented by the community. This research provides insight for policy makers and city managers to understand the broad impact of smart cities on community behavior.

Keywords: Consumer Behaviour, Literature review, Smart City

1. INTRODUCTION

As technology advances and urbanization continues, cities around the world are facing major challenges such as overpopulation, traffic congestion, space constraints, and financial concerns. The increasing trend of urbanization every year forces governments to look for transformative innovations to overcome these problems. One of the solutions developed is the smart city concept, which aims to make city management more efficient and improve the quality of life of its residents. [1];[2]. The smart city concept aims to make city management easier and improve the quality of life of its residents. Each city has different policies and conditions [3]. Smart city integrates digital and telecommunication technologies to optimize traditional services and reduce emissions, creating more responsive city administration, safer public spaces, smarter transportation networks, and efficient techniques for lighting and heating buildings [4].

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However, there is a significant gap between theory and practice in smart city implementation. While the concept promises many benefits, the reality on the ground often does not match expectations. One of the key issues is how to ensure that the technologies implemented actually deliver high-quality services to the city's citizens [5];[6]. Citizen participation is crucial in determining the success of smart cities, as without their feedback and active involvement, smart cities may not have any real meaning or value [7]. In Cohen (2010) paper in [8] it is argued that cities should be seen as a collection of data that can be transformed into a more "smart" model that connects residents with the city itself. Therefore, technology should be used to assist city development with a focus on the connection between people, information, and city elements. In addition, the implementation of smart city should also consider social and environmental aspects. This concept is not only about technology but also how it can create a sustainable and greener urban environment, as well as improve the quality of life of its residents [9]; [10]. Citizen participation and easy access to smart city policies and services are essential to ensure that citizens' needs and concerns are properly addressed [11];[12].

Once smart city implementation has taken place, the transformation will not only impact the city's infrastructure and operations. It also significantly affects the changes in people's daily routines and lifestyles. The introduction of smart city technology affects the way individuals live their lives, from how they interact with public facilities to their consumption patterns [13]. In addition, technology also brings changes in consumer behavior in urban environments, creating new lives and changing their preferences and expectations for various services and products [14]. Therefore, it is important to understand how smart city technologies affect people's behaviors and habits, and how they can adapt to these changes to improve the quality of life in urban environments. Further research is needed to explore the impact of smart city technologies on consumer behavior and daily routines of urban residents.

This literature review will provide a comprehensive overview of how smart city technologies can change people's daily lives and consumption behaviors, as well as provide insights into strategies that can be taken to maximize the benefits of implementing these technologies. The main research questions are "How does smart city technology affect consumer behavior in urban environments?" and "How does the application of smart city technology affect the daily routines and lifestyle habits of urban people?" focusing on the broad impact of this technology on urban society.

This literature review is important to understand the extent to which smart city technology can change people's daily lives and consumption behavior. This study shows how the implementation of smart city changes citizens' behavior. This

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article is organized as follows: First the research methodology using PRISMA; then, the articles used as literature reviews are outlined to give an overall overview of the two research questions. Finally, results can be made to help future research.

2. METHODS

In structuring the literature review questions, a mapping of what will be discussed further was conducted using vosviewer. This stage helps us define the scope of the research and helps us guide the review process. The research questions and explanation of the review method will be the main focus. To know what has been discussed in the scope of smart city, mapping is required before defining the research questions.

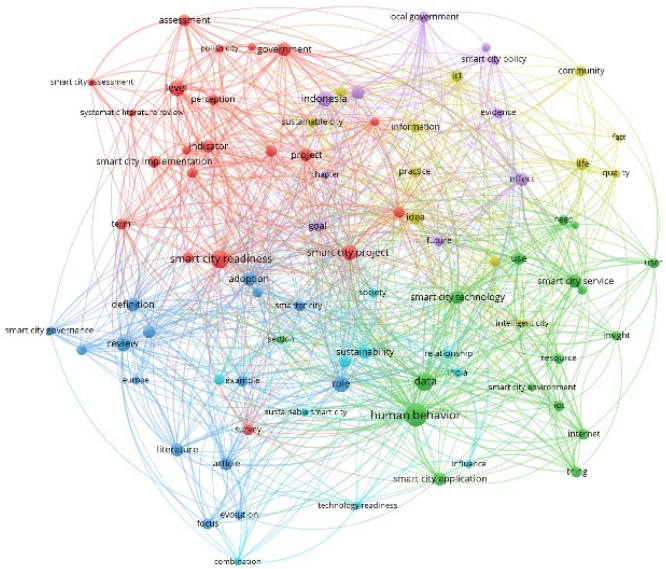

Figure 1. Vosviewer Mapping

Based on the mapping results in Figure 1, there are still several sections that discuss the implementation of smart city technology that has an impact on changes in people's behavior. The purpose of this literature review is to find out how the implementation of smart cities impacts changes in behavior and daily activities. There are not many discussions related to the impact of behavioral changes that are felt after a city implements a smart city. This literature review will prove the findings of [14] which say that the application of technology in the urban environment will bring changes in consumer behavior, create new lives and change preferences for expectations of services and products. The scope that will be described is about the impact and changing aspects of people's behavior after the implementation of smart city technology. The research question are:

1) In what ways do smart city technologies influence consumer behavior in urban environments?
2) How does the implementation of smart city technologies affect the daily routines and lifestyle habits of urban residents?

After defining the research question, the next step is to search for articles that support or match the literature review made. This article search can be done through Google Scholar and Scopus. The keywords used are "smart city", "smart city impact", "human behavior smart city", and "human change smart city". The search process is shown in Figure 2.

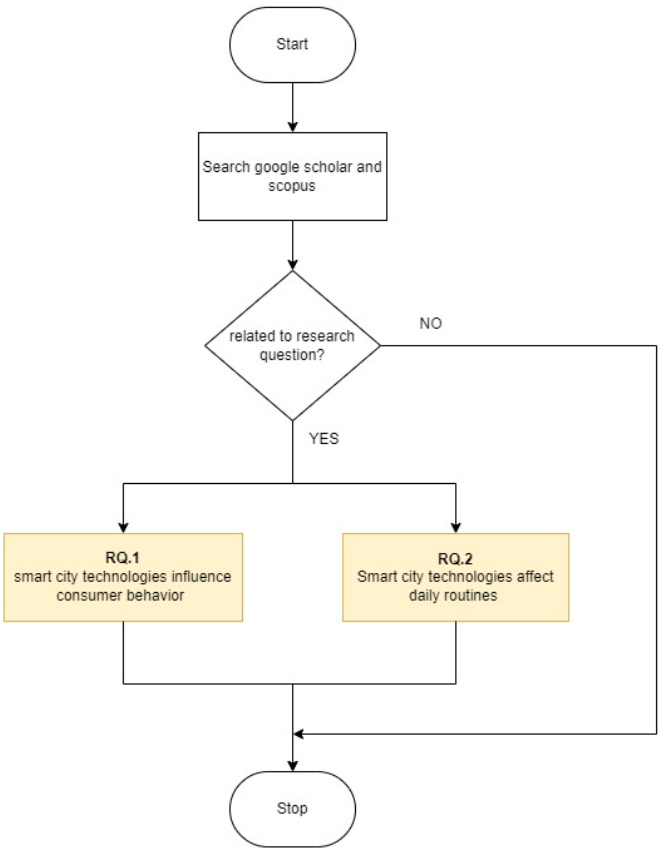

Figure 2. Flowchart Search Process Article

Figure 2 describes the process of searching for articles related to the topic or research question developed. Articles from Google Scholar and Scopus were then selected based on suitability to the research question and then used as a reference to create a literature review. By using keywords related to smart city and its impact, 200 papers from Google Scholar and 200 papers from Scopus were obtained.

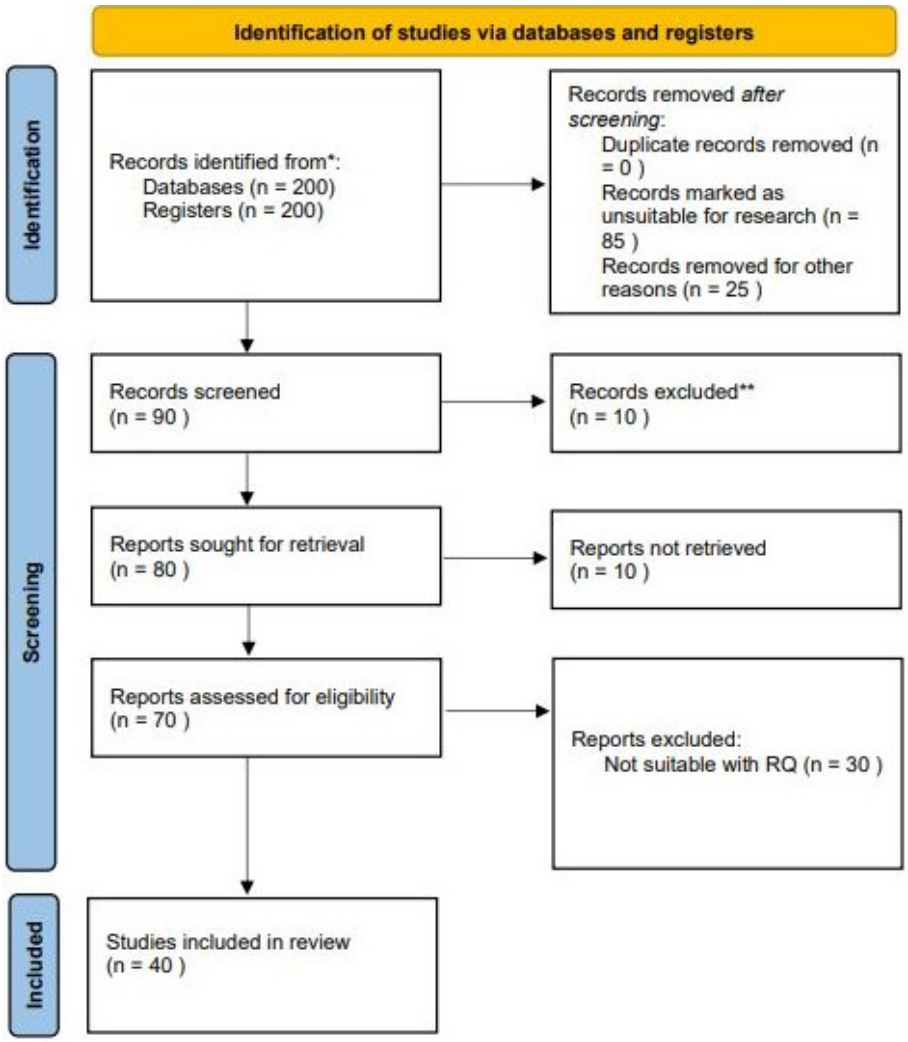

Figure 3. PRISMA Flowchart

The finding papers from the database, screening was then performed using PRISMA [15] described in Figure 3, which determined which papers to include in the literature review. The first screening was done after finding 200 papers from Google Scholar and 200 papers from Scopus. Based on topic suitability and interest, 90 relevant papers were obtained. Then screening was done through the initial review, which was based on title, keywords, abstract, and others. 20 papers were eliminated, leaving 70 papers. The next step is to determine their suitability for the research questions that have been made, so that 40 papers are obtained as the main reference in this literature review. It is possible that there will be more papers that will be used as references in the future.

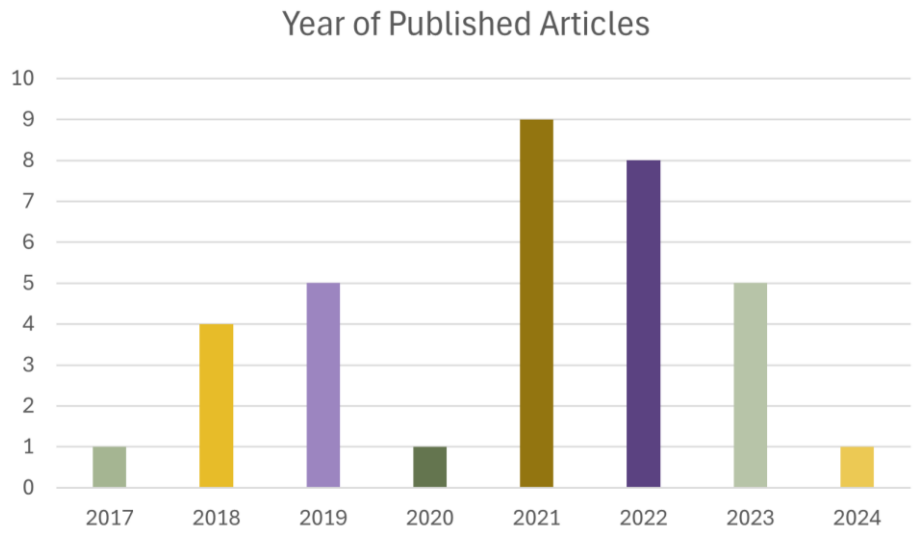

Figure 4. Year of Published Article

Figure 4 shows the year of publication of each article used as a reference. The oldest article used in this literature review was published in 2017 and the latest uses the publication of 2024 as many as 2 articles. The most use of articles is published in 2021. Furthermore, these articles will be used as references to get the impact of changes in community behavior that occur from the implementation of smart city technology in an area.

3. RESULTS AND DISCUSSION

3.1. Smart city technology influence consumer behaviour in urban environments

Developing smart city is considered as a general approach to fulfill urban functions that meet the needs of citizens [16];[17]. The development of smart city involves building various infrastructures to improve urban functions such as transportation, electricity, and public facilities, which are the basis for effective, understandable, and connected communication channels with the citizens [18];[19]. The resources that cities require are constantly changing as the Citizens grow. It is important to emphasize not only the technological aspects that are a major part of smart city development, but also the idea of a sustainable smart city. This view is linked to the sustainability model, which combines economic, social and environmental aspects. The social component of the sustainability model is the most important when talking about smart cities because smart cities should offer a good quality of life for their residents [11].

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Research conducted by [20] developed the EEIPF (Energy Efficient Integrated Planning Framework), a framework that can be used to find the most cost-effective and environmentally responsible energy efficiency solutions. Primary and secondary strategies are required in smart city energy efficiency planning. This energy efficiency is required due to the increasing population, rising energy demand, and the development of densely populated smart city areas. One example of smart city implementation in the infrastructure part of the city is smart transportation supported by sensors. The sensors measure the distance of the vehicle from the surrounding objects by using the reflection time of the sound waves from the objects. Then, as the vehicle gets closer, the sensor alerts the driver. Electromagnetic sensors generate an electromagnetic field around the bumper. If something enters, the sensor sends a signal [21];[22]. The larger a city is, the increased energy demand produces more contaminants in these urban areas [23]; [24]. Reduction of air quality and treatment of heat problems can increase oil demand [25]; [26]. Urban life relies heavily on energy efficiency, which includes the creation and implementation of energy-efficient living things. Renewable energy is one of the most difficult issues in big cities due to the nature of energy sources and their important role. If there is a mix of education at all levels, heritage, business and commerce, a technologically enhanced smart city has social value. If the application is correct, the concept of smart cities is easier to create and clearer. Smart cities can also offer promising and sustainable urban business prospects.

One powerful driver of smart city implementation is natural conditions. For example, the outbreak of the COVID-19 pandemic is considered a public emergency. This event had a significant impact in more than 100 countries around the world for more than a year. The spread of this pandemic has affected the status and progress of various parties and fields in society, such as improving smart city services. Smart city is a new idea and model of urban development and have received significant attention from academics in recent years [27];[28]. Based on [29]; [30], smart city is a city that has a high level of performance and has intelligent characteristics based on a combination of self-aware, independent and autonomous citizen activities. In the research conducted by [7], it was discussed how the quality of smart city services influences citizen involvement in public emergency situations. The case study for this research is a smart city in China. Several things were discussed, such as service quality. High quality of service in smart city systems, including reliability, speed and accuracy of information, significantly increases citizen engagement. Citizens are more likely to actively participate in emergency situations if they believe in the effectiveness of the services provided by smart cities. Apart from service quality, community involvement is also considered. Citizen involvement has become more critical. Quality smart city services help reduce citizens' uncertainty and anxiety, so they are better prepared and responsive to necessary instructions and actions during a crisis. This finding is in line with what was stated by Afzalan [31] in [32] and [27]

in [28] namely that smart cities cannot provide quality services. to its citizens, then a smart city will have no meaning and value to build. Therefore, smart city managers must consider how to provide high-quality services to their citizens. Citizen engagement, an aspect of smart characteristics, is an efficient way to measure the quality of smart city services. Overall, efficient and reliable smart city services increase citizens' trust and engagement in dealing with public emergencies, making cities more resilient in crisis situations.

Other research by [33] discusses how the application of the smart city concept affects human behavior, especially in the context of sustainable mobility. In the current context of urban politics, being "smart" seems to equate to combining different assumptions and practices to improve urban metabolism through the use of technology and experimentation [34]; [33]. Providers of smart city "solutions" have involved city governments [35]; [36] so that behavior change to eradicate old problems such as congestion, air pollution, and climate change targets is very important. Based on the results of the research, there are several behavioral changes that are felt after a city implements a smart city. Prior to smart city implementation, city mobility was often inefficient with high traffic congestion, lack of public transportation integration, and heavy reliance on private vehicles. Citizens tend to pay little attention to the environmental impacts of their mobility choices, such as high carbon emissions from motor vehicles. In addition, information on transportation and road conditions is scattered and not integrated, making effective travel planning difficult. Following the adoption of smart cities, the implementation of technologies such as smart transportation systems, traffic management applications, and ridesharing improves mobility efficiency and reduces congestion. Smart cities also encourage the use of green transportation by providing real-time information and incentives to use public transportation or green alternatives. Transportation information becomes more integrated and accessible through smart apps that help with trip planning, increasing awareness and compliance with traffic rules and road conditions.

The implementation of smart cities is not just a relationship between technology and humans, one of the things that is related is interactive media and media art. Through these two aspects, people will know more about smart city. Based on research [37];[38] discusses how art media can encourage behavior change in smart cities. An example is the application of media technology in public spaces. Interactive technology in public spaces helps increase public awareness of environmental issues. By utilizing interactive media art installations, citizens can learn about the importance of protecting the environment in a more interesting and memorable way. In addition, the use of media and art is able to bring about sustainable mobility behaviors, namely, to learn about efficient and environmentally friendly traffic management and public transportation information. The use of interactive media technology in public spaces can also

serve as an educational tool, providing important information about health, safety, and city policies to citizens. This increases their knowledge and awareness of various issues that affect their daily lives.

The research by [39] explains the impact of human behavior change in the context of online civic engagement in smart cities through several key factors. First, smart cities utilize information and communication technology (ICT) to enhance citizen participation in governance and decision-making processes, which encourages more active and widespread civic engagement on digital platforms. Second, the use of advanced technologies in smart city increases citizens' confidence in using digital tools, which in turn increases their engagement in online civic activities. Third, the adoption of smart city technologies also strengthens citizens' sense of attachment and commitment to their communities, motivating them to more actively participate in social issues and community activities online. Finally, smart cities that facilitate interaction through social media and digital platforms lead to significant changes in social behavior, where citizens become more connected, collaborative and proactive in addressing community issues.

The research by [40] highlights the important role of local online platforms in sustaining local purchasing power by integrating various services and adapting to future smart retail. The implementation of smart retail in smart cities improves operational efficiency and provides a better shopping experience for consumers through technologies such as digital payments, data analytics, and apps that connect customers with local offerings. This allows consumers to shop more easily from home, get personalized product recommendations, and take advantage of fast delivery services. As a result, consumer expectations of retail service efficiency and convenience are rising, while businesses are forced to become more innovative and responsive to dynamic market needs. In line with Schade's research, [41] reinforces his research that online platforms help future business development. With a German case study and highlighting the changes that occurred after the COVID-19 crisis, it is said that digital platforms have substantial power in determining the workflow and success of small retailers. While digital platforms play an important role in supporting digital transformation, they also create new challenges regarding dependency and competition in the evolving retail market. Overall, the integration of smart technologies in retail creates a more efficient and sustainable local economic ecosystem. Table. 1 shows the related aspects and changes that occur after implementing smart city.

Table 1. Aspects and Comparison of Behavior Change

Aspect	Before Smart City Implementation	After Smart City Implementation	Source
Mobility	High traffic jam, dependency on personal vehicles, lack of public transportation integration	Increased mobility efficiency, use of green transportation, traffic management applications	[33]
Energy Efficiency	High energy consumption rate, increased air contamination, uncontrollable heat problem	Implementation of energy efficiency solutions, reduction of carbon emissions, use of renewable energy	[20]; [23]; [24]; [25]; [26]
Citizen Engagement	Limited citizen participation in decision-making, less active citizen engagement	Citizen engagement increases through digital platforms, trust in city services increases.	[7]; [39]
Environmental Awareness	Poor awareness of environmental issues, environmentally unsustainable behavior	Environmental awareness raised through interactive technology and media art in public spaces	[37]; [38]
Shopping Experience	Conventional shopping with low efficiency, limited access to products	Easier shopping through smart technology, personalized shopping experience, fast delivery	[40]; [41]
Quality of Life	Health problems due to pollution, limited access to public services, scattered and unprotected information	Quality of life improves with reliable and efficient smart city services, integrated information	[29]; [11]
Education & Information	Access to information is scattered, education is not integrated with technology	Integrated education and information through smart technology, increased citizen knowledge	[37]; [38]; [39]
Business Prospects	Local businesses underdeveloped, reliance on conventional methods, hindered when COVID-19 happened.	More efficient and sustainable local economic ecosystems, innovative and responsive businesses	[40]; [41]
Response to the Crisis	Difficulty in dealing with public emergencies, slow response	City is more responsive in crisis situations with fast and accurate services, active citizen participation	[7]; [31]; [32]; [27]; [28]

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3.2 The implementation of smart city technologies affects the daily routines

The implementation of smart city technology has had a significant impact on the daily routines and lifestyle habits of urban communities. One of the main aspects affected is mobility and transportation. Before the adoption of smart cities, urban mobility was often inefficient with high traffic congestion and a lack of public transport integration. However, after the implementation of smart cities, technologies such as smart transportation systems, traffic management applications, and vehicle sharing have increased mobility efficiency and reduced congestion. In addition, people are encouraged to use environmentally friendly transportation through the provision of real-time information and incentives to use public transportation or green alternatives. Integrated and easily accessible transportation information via smart applications has also increased awareness and compliance with traffic rules and road conditions [33]. With smart transportation, efficient traffic management, and better public facilities, urban communities can enjoy easier and more comfortable access to various important services and facilities in their daily lives [16];[11].

Aside from mobility, smart city implementation also affects consumer behavior and shopping experiences. With the adoption of smart retail in smart cities, retail operational efficiency increases, and consumers can enjoy a better shopping experience through technologies such as digital payments, data analytics, and apps that connect customers with local offers. This allows consumers to shop more easily from home, get personalized product recommendations, and take advantage of fast delivery services. As a result, consumer expectations for the efficiency and convenience of retail services are increasing, while retail businesses are becoming more innovative and responsive to dynamic market needs [40];[41]. Not only that, focusing on energy efficiency and resource use, smart city is able to implement solutions that reduce excessive energy consumption and promote the use of renewable energy sources [20]. This not only helps reduce contaminants in urban areas but also supports more sustainable and energy-efficient living, making a positive contribution to the environment and societal well-being [25]; [26].

Moreover, the application of smart city technologies also affects online civic engagement and social interaction. Smart cities leverage information and communication technologies to increase citizen participation in governance and decision-making processes, which encourages more active and widespread civic engagement on digital platforms. The adoption of smart city technology also strengthens citizens' sense of attachment and commitment to their communities, motivating them to more actively participate in social issues and community activities online. Interaction through social media and digital platforms has also led to significant changes in social behavior, with citizens becoming more connected, collaborative, and proactive in addressing community issues [39]. City

public awareness is also triggered by the use of media arts to promote the implementation of smart city cities [37]; [38]. Overall, the application of smart city technology brings positive changes in the lifestyle and daily routines of urban residents. The application of smart city technology has changed not only the physical infrastructure of cities, but also the behavioral patterns and lifestyles of urban communities.

Although the positive impact of implementing smart city technology is evident, there are also some changes that may seem a little negative. In research [42] it is said that the implementation of technology in the smart city concept has a tendency to reduce traditional social interactions because many activities can be carried out digitally and remotely. Reduced face-to-face interaction will replace the need for direct social interaction in many aspects of daily life [43]. This can trigger individualism in society. An example research [44] which uses a case study in India shows that the implementation of a smart city reduces physical human interaction in various sectors such as banking, transportation, water management and electricity which is expected to produce a more efficient and sustainable smart city. In another study [45], it was also said that apart from having positive things, there are negative impacts from the implementation of smart cities, namely reduced socialization and a tendency to be closed off from both the community and government perspective.

These findings are in line with the impact theory of digital media [46]. This theory regarding the impact of digital technology suggests that technological developments, especially social media, are changing people's behavior by reducing direct interaction and strengthening individualism. This technology allows people to interact virtually, which can reduce the need for face-to-face interaction and increase individualistic behavior. Overall, the application of smart city technology brings positive changes in the lifestyle and daily routines of urban residents. If it looks a little negative, it depends on the perception of how people apply it in their daily lives. The application of smart city technology has changed not only the physical infrastructure of cities, but also the behavioral patterns and lifestyles of urban communities as a whole.

3.3 Discussion

The implementation of smart city technology is significantly transforming the behaviors and daily lives of urban residents by introducing innovative solutions across multiple domains, such as transportation, retail, energy management, and public engagement. Technologies like smart transportation systems, digital payments, and data analytics are revolutionizing how people navigate cities, make purchases, and consume energy. For example, the use of real-time traffic management applications and ride-sharing services has led to more efficient urban

mobility and reduced congestion, while digital payment systems and personalized shopping experiences have reshaped consumer habits by making transactions faster and more convenient. Furthermore, the promotion of renewable energy sources and data-driven strategies for reducing energy consumption contribute to lower emissions and support environmental sustainability.

Despite these numerous advantages, the adoption of smart city technologies also brings challenges, particularly in terms of social interactions. As more activities shift to digital platforms, there is a decline in face-to-face communication, potentially leading to increased social isolation and a more individualistic society. Research has shown that while smart cities enhance operational efficiency and citizen convenience, they can also diminish traditional social interactions. For instance, digital platforms for services like banking, transportation, and public utilities reduce the need for direct human contact, potentially weakening the social fabric that binds communities together. This trend is particularly evident in areas where smart technologies have been heavily integrated, such as smart city initiatives in India, where the reduction in physical human interaction has been observed across several sectors.

Furthermore, the findings highlight that while smart city technologies can significantly improve civic engagement by leveraging digital tools, they may also create a dependence on virtual interactions that lack the depth of traditional, in-person exchanges. While platforms for online civic engagement increase participation in governance and decision-making, they can also reinforce a form of interaction that is less personal and more transactional. This change can affect community cohesion, as individuals become more accustomed to engaging with their communities from behind screens, rather than in shared physical spaces. As the digital environment grows, there is a risk that these virtual engagements could replace more meaningful, face-to-face interactions, thereby diminishing the quality of civic life.

The research also points out that smart cities need to strike a balance between technological advancement and maintaining a sense of community. While smart technologies provide tools that make urban living more efficient and sustainable, they must be implemented in ways that also promote social cohesion. For example, integrating interactive public spaces with media art and information technology can help raise environmental awareness and encourage community participation in sustainable practices. By combining technological innovation with efforts to enhance social interaction, cities can foster a more inclusive environment that supports both digital and personal engagement. This balanced approach ensures that the benefits of smart city technologies do not come at the cost of weakening social ties and community values.

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The smart city technologies offer many benefits, such as increased efficiency, convenience, and sustainability, they also present challenges that must be carefully managed. Urban planners and policymakers need to consider the dual impact of these technologies on both the functional and social dimensions of city life. To maximize the positive effects, a holistic approach that promotes both technological innovation and community engagement is necessary. This strategy will help ensure that the development of smart cities enhances not only the quality of urban services but also the social fabric that supports vibrant, resilient communities.

4. CONCLUSION

The influence of smart city technology on consumer behavior in urban environments and people's daily routines and lifestyle habits is significant. The development of smart cities through the application of various technologies such as smart transportation systems, traffic management applications, and smart sensors has improved mobility efficiency and reduced congestion in cities. This has changed the behavior of people who previously tended to depend on private vehicles to prefer environmentally friendly transportation and sharing. In addition, the integration of technology in public spaces through interactive media and media art has also brought about changes in environmental awareness and sustainable mobility. Other changes are also shown in community engagement in emergency situations and online civic activities. Information and communication technologies implemented in smart cities facilitate citizen participation in decision-making processes and online community activities. This promotes more active and widespread civic engagement on digital platforms, and strengthens citizens' sense of attachment and commitment to their communities. The integration of smart technologies in retail in smart cities improves operational efficiency and provides a better shopping experience for consumers through technologies such as digital payments and data analytics.

Thus, the application of smart city technology not only transforms city infrastructure and services, but also brings significant changes in citizen behavior and engagement. This shows that the smart city concept is not only related to technological aspects, but also involves the integration of the idea of a smart city that is sustainable and oriented towards the quality of life of its people. The daily lives of city residents who have implemented smart cities are also experiencing changes. This change is due to the use of technology which certainly makes things easier and has a positive influence on daily activities. However, it does not rule out the possibility that from another perspective there may be other impacts such as a tendency to become individualistic which is felt to be capable of disrupting existing social interactions. Social interaction activities will decrease with the sophistication of smart city technology used. For future research could expand beyond

behavioral changes in urban communities to explore the social, technological, and environmental aspects of smart city implementation, thereby providing a more holistic understanding of behavioral changes and other benefits.

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