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## **Sustainable smart cities: the contribution of IoT-enabled technologies under vision 2030**

### **Abstract**

The fast pace of urbanization has also contributed to an increase in the sustainability issues that are being experienced in urban and city centers, which include energy, environmental, transportation, and service delivery issues, among others. It is in this context that the development of smart cities has been identified as an approach that seeks to achieve sustainability in urban and city centers through the use of digital technologies, and in this regard, IoT has been identified as an enabler that facilitates data acquisition, decision-making, and optimization in urban and city centers, among others. This paper seeks to analyze the role that IoT technology plays in creating smart and sustainable cities, with particular reference to Saudi Vision 2030. This paper seeks to analyze, through an in-depth analysis of literature from all over the world, the role that IoT technology plays in facilitating sustainability factors such as energy, transportation, environmental, governance, and quality of life in urban and city centers, with particular reference to smart city development. This paper seeks to highlight that it is within this context that smart city development, as an approach that seeks to achieve sustainability in urban and city centers, that the strategic approach that the Saudi government has taken towards digital transformation and smart city development is at the core of their development agenda, as highlighted within Saudi Vision 2030. The findings from this paper are that IoT technology has an impact on efficiency, sustainability, and response in urban and city centers, and in this regard, this paper seeks to reveal that the challenges that smart city development face are security, interoperability, and governance, which are core factors that facilitate smart city development and sustainability, and in this regard, this paper seeks to contribute to the existing literature on smart city development and sustainability by proposing a conceptual approach towards smart city development and sustainability, which is consistent with Saudi Vision 2030, with particular reference to IoT technology.

30 **Keywords**

31 Smart Cities; Internet of Things; Sustainability; Saudi Vision 2030; Digital Transformation;  
32 Urban Development

33

34 **Introduction**

35 The problem of rapid urbanization has become one of the most significant factors that define the  
36 twenty-first century, and it has created a series of opportunities and challenges in relation to  
37 sustainability and development. Urbanization has created a series of challenges in relation to  
38 energy, transportation, environmental, and social issues, and the traditional management systems  
39 of the city are not efficient in relation to the resolution of the aforementioned challenges, which  
40 are causing problems like energy waste, transportation, environmental pollution, and a reduced  
41 quality of life, among others. (Jeddah strategic approaches to sustainable urban development and  
42 vision 2030 alignment, 2020, pp. 523-531) Therefore, the cities around the world are looking for  
43 innovative solutions that can support the development of sustainable development, and in this  
44 regard, the development of smart cities has become a significant issue, and the concept of  
45 sustainability has become a significant factor in the development of smart cities, which are based  
46 on the use of digital technology and intelligent systems that can support the development of  
47 sustainable development and increase the level of efficiency in their traditional management  
48 systems. (Mutambik, 2023) Among the digital technologies that can support the development of  
49 smart cities, the Internet of Things (IoT) has become a significant factor in relation to  
50 sustainability, and it has become a significant factor in the development of sustainable smart  
51 cities in developed and emerging nations. (Park et al., 2018, p. 1388)  
52 The IoT technologies are a set of technologies that are playing an important role in the  
53 development of sustainable smart cities, and these are creating a range of opportunities in  
54 relation to sustainability and development, and these are helping in the development of  
55 sustainable cities that are able to optimize their systems, such as energy, transportation,  
56 environmental, social, and many other systems, and these are creating a range of opportunities in  
57 relation to sustainability and development. (Leveraging advanced digital technologies for smart  
58 city development in Saudi Arabia: opportunities, challenges, and strategic pathways, 2023, pp. 1-

59 12) Saudi Arabia has recognized the importance of the role that digital technology has to play in  
60 resolving the challenges of sustainability while promoting the development goals of the nation.  
61 Saudi Arabia has an ambitious agenda for the development of the nation up to 2030, as  
62 highlighted in the Saudi Vision 2030, which includes the diversification of the economy, digital  
63 transformation, quality of life, and many other areas. (Saudi Arabia's Vision 2030: Pioneering  
64 Industrial Transformation and Economic Diversification, 2024) Smart city development is one of  
65 the major components of the Saudi Vision 2030, as the Kingdom has invested heavily in the  
66 development of smart cities. (Saudi Arabia Smart Cities Market | 2019 – 2030 | Ken Research,  
67 n.d.) Projects such as NEOM are an example of the commitment of the Saudi government to the  
68 adoption of advanced technology, such as IoT, in the development of smart cities. (Leveraging  
69 advanced digital technologies for smart city development in Saudi Arabia: opportunities,  
70 challenges, and strategic pathways, 2023) There are still some challenges that are associated with  
71 the implementation of the IoT technology in the development of smart cities, even though the  
72 technology has been widely accepted in the development of smart cities. There is still  
73 insufficient research regarding the implementation of the IoT technology in the development of  
74 smart cities, since the issues of data security, sustainability, and other challenges that are  
75 associated with the implementation of the IoT technology still exist. (Alotaibe, 2024, pp. 14109-  
76 14118) Although various studies have been done regarding the implementation of the IoT  
77 technology in the development of smart cities, insufficient research has been done regarding the  
78 implementation of the IoT technology in the context of the development goals of various nations,  
79 such as the Saudi Vision 2030. (Alajmi, n.d.) In an attempt to bridge this gap, this research seeks  
80 to contribute to the discussion of the value that can be added from IoT technologies in supporting  
81 the development of sustainable dimensions of smart cities, as discussed in Vision 2030. A  
82 conceptual approach for this research, which entails literature review, was adopted in an attempt  
83 to identify the value that can be added from IoT technologies in supporting the development of  
84 sustainable dimensions of smart cities. The objectives of this research can be summarized as  
85 follows: the general objective of this research is to analyze the value that can be added from IoT  
86 technologies in supporting the development of sustainable dimensions of smart cities, as  
87 discussed in Vision 2030. This research also seeks to analyze the value that can be added from  
88 IoT technologies in supporting the development of sustainable dimensions of smart cities,  
89 considering the strategic objectives of the Saudi Vision 2030 for smart cities. This research also

90 seeks to identify the value that can be added from IoT technologies in supporting the  
91 development of sustainable dimensions of smart cities, considering the challenges that can be  
92 encountered in adopting IoT technologies in smart cities. This research contributes to the  
93 academic literature in that it provides a framework for smart cities that aligns with the strategic  
94 objectives of the Saudi Vision 2030, considering the technological, sustainability, and strategic  
95 dimensions of smart cities.

96 The rest of this paper is outlined as follows: in the second section of this paper, the literature  
97 review of the concept of sustainable smart cities will be presented. Furthermore, the smart city  
98 concept under the Saudi Vision 2030 will be presented in the third section of this paper.  
99 Moreover, the role of IoT technology in enhancing the sustainability of smart cities will be  
100 analyzed in the fourth section of this paper. Furthermore, the discussion of the research findings  
101 will be presented in the fifth section of this paper, while the conclusion of this research will be  
102 presented in the last section of this paper.

103

## 104 **Background and Literature Review**

105 The complexity of urban systems has led to the development of innovative strategies to create  
106 smart and sustainable cities. Smart and sustainable cities are the product of the union of  
107 sustainability and digital technology. Smart cities are cities that incorporate advanced  
108 information and communication technology to improve the quality of services delivered to their  
109 citizens. Sustainability, in this case, refers to the efficient and effective use of resources, the  
110 environment, and quality of life. The Internet of Things (IoT) has been identified as one of the  
111 technologies that can be used to develop smart cities. IoT connects physical infrastructures  
112 through sensors, software, and communication technology to enable real-time monitoring and  
113 control of the infrastructures. From the literature, it is clear that IoT has the potential to transform  
114 the city to become more dynamic and adaptable. Research has been conducted to show the  
115 potential of IoT to achieve environmental sustainability in smart cities. IoT-based energy  
116 management systems have the potential to improve the supply and usage of electricity and eco-  
117 friendly sources of energy. Smart grids, which are IoT-based, are also useful in identifying and  
118 solving inefficiencies in the supply and usage of electricity.

119 IoT-based environmental monitoring systems are crucial in ensuring environmental sustainability  
120 in smart cities. The second domain that the potential of IoT was explored is transportation and  
121 mobility in smart cities. From the research conducted in this domain, it was identified that IoT-  
122 based intelligent transportation systems have the potential to be utilized in the development of  
123 smart cities, as IoT has the potential to collect data and develop intelligent systems that can be  
124 used to control transportation in smart cities, thereby improving transportation in smart cities and  
125 making it more efficient and effective. From the research conducted in this domain, it can be  
126 identified that the potential of IoT is directly linked to sustainability, as IoT can be used to  
127 reduce pollution in smart cities through the reduction of fuel consumption, as identified in the  
128 research conducted in this domain. From the research conducted in this domain, it can be  
129 identified that IoT can be used to achieve sustainability in the transportation domain in smart  
130 cities. Apart from the potential applications mentioned above, IoT technology has been explored  
131 in relation to smart governance within smart cities. In this case, smart governance within smart  
132 cities can be improved through the application of IoT technology. In this case, IoT technology-  
133 based waste management can be used for improving efficiency within smart cities, while smart  
134 lighting technologies can be used for improving lighting conditions as required within smart  
135 cities. In this case, it can be seen that the potential applications are closely aligned with the  
136 concept of social sustainability, as IoT can be used for improving the quality of life within smart  
137 cities. However, despite the fact that the above benefits of the application of Internet of Things  
138 technology in the development of smart cities have been identified, there are some challenges  
139 associated with the application and adoption of Internet of Things technology in the development  
140 of smart cities, as identified in the existing literature. Some of the challenges include data  
141 security and privacy, which is still a great challenge considering the amount of data that is  
142 generated in the application of Internet of Things technology in the development of smart cities.  
143 Another challenge is the interoperability of different kinds of Internet of Things technologies  
144 with existing technology infrastructures. Based on the above public policies, the success of the  
145 application of the Internet of Things technology in the development of smart cities is also  
146 dependent not only on the level of development of the Internet of Things technology but also the  
147 strategic aspect in terms of the national development policies. In fact, the integration of the  
148 national sustainability policies and the digitalization policies in the development of smart cities  
149 in the application of the Internet of Things technology is more significant. It is therefore clear

150 that nations have achieved more success in the development of smart cities in the application of  
151 the Internet of Things technology than in the absence of the integration of the national  
152 development policies. However, the literature with regard to the application and adoption of the  
153 public policies in the development and application of the Internet of Things technology in  
154 specific regions of the Middle East is still limited. From the point of view of Saudi Arabia,  
155 literature that has been written regarding the application and adoption of IoT technologies has  
156 mainly concentrated on the development and application of smart city technologies. However,  
157 little emphasis has been given to the overall role that IoT technologies can play towards the  
158 sustainability goals that were set in Vision 2030. Although literature has been written regarding  
159 the role that IoT technologies, such as NEOM, can play towards the development and application  
160 of smart city technologies, little emphasis has been given to the overall conceptual role that IoT  
161 technologies can play towards the sustainability goals that were set in Vision 2030. This,  
162 therefore, highlights an important gap that needs to be filled regarding the application and  
163 adoption of IoT technologies from the point of view of Vision 2030.

#### 164 **Conclusion**

165 In conclusion, it is vital to appreciate the role that IoT technologies can play in the development  
166 and application of smart cities along different dimensions. This is due to the fact, as highlighted  
167 in the literature, energy management, transportation, environmental protection, as well as  
168 governance are some of the vital areas that have benefited significantly in terms of sustainability  
169 due to the application and adoption of IoT technologies. The study, therefore, has relied on  
170 literature regarding the application and adoption of IoT technologies for the development and  
171 application of smart city technologies. This, therefore, underscores an important contribution that  
172 has been made by this study towards the development of literature regarding the application and  
173 adoption of IoT technologies for the development and application of smart city technologies.

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177 **Saudi Arabia's Vision 2030 and Smart City Strategy**

178 It is submitted that the vision 2030 of Saudi Arabia can be considered an overarching vision that  
179 aims to change the face of the nation, shatter the chains of oil addiction, diversify the economy  
180 of the nation, and improve the lifestyle of the nation. It is also submitted that the digital  
181 revolution and sustainability can be considered two of the pillars of the vision of the nation. It  
182 can also be submitted that the smart city strategy can be considered a strategic vision that aims to  
183 change the face of the cities of the nation, shatter the challenges of the nation, and improve the  
184 lifestyle of the nation. It can also be submitted that the digital technology, especially the Internet  
185 of Things, can be considered two of the components in realizing the vision of the nation, as  
186 outlined in the vision 2030 strategy of the nation. It can also be submitted that the vision 2030  
187 framework of Saudi Arabia has also considered the development of vibrant cities, which can  
188 compete in the region. The programs of the nation, which include the National Transformation  
189 Program and the Quality of Life Program, have taken into account the concept of smart cities,  
190 which have the potential to develop smart infrastructure, digital government, and green planning  
191 in the nation. It can be noted that the concept of smart cities has the potential to integrate  
192 economic growth, social inclusion, and sustainability in the nation or the particular region in  
193 question. It can also be noted that the Internet of Things technologies have the potential to  
194 integrate with the concept of smart cities in the nation of Saudi Arabia, considering the potential  
195 of these technologies to provide real-time visibility in the metropolitan spaces of the nation in  
196 question. It can be noted that this has been considered a crucial factor in the municipal areas of  
197 the nation, considering the potential of these technologies to provide sustainability in the nation  
198 in question, as seen in the Vision 2030 strategy of the nation in question. The Internet of Things  
199 technologies, in particular, have provided the municipal areas of the nation with the potential to  
200 monitor continuously the energy, transportation, environment, and spaces in the nation in  
201 question. Some of the major projects that have been undertaken include the application of the  
202 IoT technology as per the objectives and goals set by the government of Saudi Arabia. Some of  
203 the projects that have been undertaken include the development of smart energy systems, smart  
204 transportation systems, smart services, smart environment systems, among others. The projects  
205 that have been discussed above have shown that there is a change in the objectives of  
206 infrastructure development in Saudi Arabia from conventional infrastructure development to  
207 high-tech infrastructure development. The application of IoT technology in infrastructure  
208 planning in Saudi Arabia has been carried out with the aim of developing infrastructure that is

209 strong enough to accommodate the population that is expected to develop in Saudi Arabia in the  
210 future. Looking at the application of IoT technology from the governance point of view, Vision  
211 2030 has shown that there is a need for the government of Saudi Arabia to develop a digital  
212 government that can enhance transparency in the services delivered to the citizens of Saudi  
213 Arabia. The application of IoT technology has enabled the government of Saudi Arabia to realize  
214 this objective by assuring that there is an improvement in the availability of data in the services  
215 offered to the citizens of Saudi Arabia. This has enabled the government of Saudi Arabia to  
216 develop its capacity by ensuring that IoT technology is integrated in governance. Smart  
217 governance has enabled the government of Saudi Arabia to make well-informed decisions. IoT  
218 technology-based smart cities, as outlined in the objectives and goals of Vision 2030, are made  
219 possible by the ability of the government of Saudi Arabia to address the challenges that are likely  
220 to arise during the application of IoT technology. The challenges that are likely to arise during  
221 the application of IoT technology include regulation challenges, technology challenges, and  
222 organizational challenges that need to be addressed for sustainability benefits to be achieved.  
223 It can, therefore, be concluded that Saudi Vision 2030 is creating an enabling environment for  
224 the development of sustainable smart cities by enabling IoT technology. The relationship  
225 between digital innovation alongside sustainability in Saudi Vision 2030 is creating a strategic  
226 foundation for smart cities. This is important since it enables IoT technology to be part of  
227 sustainability.

228 **Figure 1. Conceptual Framework of IoT-Enabled Sustainable Smart Cities under Saudi**  
 229 **Vision 2030**



230

231 **Description:**

232 This conceptual framework illustrates the integration of IoT-enabled technologies with Saudi  
 233 Vision 2030 sustainability objectives. IoT applications (energy, transportation, environment,  
 234 governance, and public services) act as enablers that support key Vision 2030 pillars, resulting in  
 235 sustainable, resilient, and intelligent urban ecosystems.

236 **Figure Components:**

- 237 • IoT Technologies (Sensors, Networks, Data Analytics)
- 238 • Smart City Domains (Energy, Mobility, Environment, Governance)
- 239 • Vision 2030 Pillars (Sustainability, Digital Transformation, Quality of Life)
- 240 • Outcomes (Efficient Services, Reduced Emissions, Urban Resilience)

241

242 **Table 1. Alignment of IoT-Enabled Smart City Domains with Saudi Vision 2030 Objectives**

Smart City Domain	IoT Application Area	Vision 2030 Objective
Energy Systems	Smart grids, energy monitoring	Environmental sustainability
Transportation	Intelligent traffic systems	Efficient mobility & reduced emissions
Environment	Air and water quality monitoring	Resource conservation
Governance	Smart public services	Transparent & digital government
Public Services	Smart healthcare and safety	Improved quality of life

243

244 **Role of IoT-Enabled Technologies in the Development of Sustainable Smart**  
 245 **Cities**

246 IoT technology has a pivotal role to play in the development of sustainable smart cities since it  
 247 has the potential to transform traditional physical and infrastructural systems into smart,  
 248 intelligent, and adaptable systems. Considering the Kingdom of Saudi Arabia’s Vision 2030, IoT  
 249 technology is highly aligned with the vision and goals set by the Kingdom of Saudi Arabia,  
 250 especially regarding the efficiency of services, sustainability, and quality of life. One of the most  
 251 significant roles played by IoT technology in the development of smart cities is related to the  
 252 efficient and smart management of energy. The real-time monitoring of electricity consumption  
 253 in residential, commercial, and industrial sectors helps in more efficient and accurate predictions  
 254 regarding the demand and distribution of power. (Hadchity, 2024) The use of smart meters helps  
 255 in the real-time monitoring of power distribution, which is helpful in making operational  
 256 decisions regarding the power grid. (Hadchity, 2024) The use of IoT technology is highly aligned  
 257 with the Vision 2030 goals set by the Kingdom of Saudi Arabia, especially regarding the  
 258 sustainability of resources and the efficient use of resources. IoT technology has a significant  
 259 role to play in the development of smart transportation and mobility since IoT technology helps  
 260 in the development of smart transportation systems through the use of data collected from  
 261 various sources, such as traffic sensors, connected vehicles, and cameras. (Leveraging advanced

262 digital technologies for smart city development in Saudi Arabia: opportunities, challenges, and  
263 strategic pathways, 2024) In addition, IoT contributes to sustainability. IoT technology can be  
264 used in the monitoring of the environment. In the context of the city, IoT technology can be used  
265 to monitor the quality of air, the level of water use, the level of waste, and the level of noise  
266 pollution. (Qurashi et al., 2025) The data collected will be used to predict the actions that will be  
267 taken in the long term. For instance, IoT technology can be used in the management of water.  
268 The technology will help minimize water waste by monitoring the level of water use. The  
269 technology will be important in water-scarce regions. (Enhancing Sustainable Water  
270 Management with IoT Sensors and Data Analytics, 2022) In addition, IoT technology makes the  
271 development of smart governance possible. The technology will help the government improve its  
272 decision-making skills. When the data collected by the various technologies deployed in the city  
273 are integrated, the government will be in a better position to understand the various operations  
274 within the various departments. This will pave the way for the development of real-world  
275 applications such as smart waste management, smart public lighting, and emergency response  
276 coordination. (Qurashi et al., 2025) The health and safety of the public will also be improved  
277 through the use of IoT technology. The technology will be used to monitor the health of patients  
278 using connected medical devices. In addition, the technology will be used in surveillance to  
279 improve public safety. (Smart Health Bracelet Equipped with AI and IoT Supports Security  
280 Personnel, 2025) However, despite the benefits associated with the use of IoT technology, the  
281 full integration of the technology in Saudi Arabia's smart cities faces certain challenges. The  
282 challenges arise due to the increased level of data privacy issues. The use of IoT technology  
283 increases the level of cybersecurity risks. In addition, IoT technology faces compatibility  
284 challenges. The IoT technology deployed in the smart city comprises various technologies that  
285 may not be compatible with each other. (Building Trust and Cybersecurity Awareness in Saudi  
286 Arabia: Key Drivers of AI-Powered Smart Home Device Adoption, 2025) Strategically, the  
287 sustainability of IoT technology in Saudi Arabia's smart cities will be determined by the level of  
288 IoT technology integration with the policies and regulatory frameworks. Vision 2030 is moving  
289 in the right direction regarding the regulation of the use of IoT technology in Saudi Arabia. The  
290 regulation will improve the conditions necessary for the development of IoT technology.

291



**Table 2. Mapping of IoT Technologies to Sustainability Outcomes**

IoT Technology	Sustainability Outcome
● Smart Grids	Efficient Services, Reduced Emissions
● Intelligent Traffic Management	Reduced Emissions, Urban Resilience
● Air Quality Sensors	Improved Public Health, Urban Resilience
● Smart Governance Platforms	Efficient Services, Smart Economy
● Remote Patient Monitoring	Improved Public Health, Efficient Services

294 A diagram showing the application domain of the IoT technology in different sectors of smart  
295 cities such as energy, transport, environment, governance, and services, and their contribution  
296 towards sustainability in Vision 2030.

297

## 298 **Conclusion**

299 In conclusion, it is very clear from the discussion in this paper that the IoT technology has the  
300 potential to significantly contribute towards the facilitation of the development of sustainable  
301 smart cities, especially within the strategic framework of Saudi Vision 2030. The development of  
302 smart cities through the application of IoT technology has the potential to significantly contribute  
303 to the facilitation of the development of sustainable smart cities in Saudi Arabia. (Hegazy, 2024)

## 304 **Discussion**

305 The findings from the research revealed that the application of IoT technology is crucial for the  
306 improvement of the development of sustainable smart cities, especially within the strategic  
307 framework of Saudi Vision 2030. (Leveraging advanced digital technologies for smart city  
308 development in Saudi Arabia: opportunities, challenges, and strategic pathways, 2023, pp. 1-12)  
309 The above paper has clearly demonstrated that the application of IoT technology plays a critical  
310 role in the facilitation of the development of sustainable smart cities. This is because it has the  
311 potential to significantly contribute towards the improvement of the efficiency and sustainability  
312 of services in different sectors of smart cities. (Alamoudi et al., 2023) The above finding from  
313 the discussion is in line with the emerging literature on smart cities, which has clearly  
314 demonstrated the potential of digital technology towards the facilitation of the development of  
315 sustainable smart cities. (Dahab et al., 2025) One of the most important things that this study has  
316 learned regarding the role that IoT technology can play in supporting the development of a more  
317 sustainable smart city is that IoT technology can function in an integrated manner. IoT  
318 technology has been proven to function in an integrated manner. (Umar & Adria, 2023) This is  
319 important, as it means that IoT technology can function as a basic component in the city. This is  
320 particularly the case in relation to energy, transportation, the environment, and governance. This  
321 is important in terms of supporting the development of a more sustainable city, particularly in the  
322 context of Vision 2030. (Alamoudi et al., 2023) This is particularly the case, as dynamic  
323 adaptability is basic to supporting the development of cities and economic diversity. (Assessing  
324 the Progress of Smart Cities in Saudi Arabia, 2023)

325 The above explanation also points towards the fact that there needs to be an alignment created  
326 between the implementation of the IoT technology and the goal of sustainability. Technology is  
327 one of the key factors that need to be considered for the implementation of the smart city project.  
328 However, the sustainability of the project needs to be considered from the point of view of the  
329 alignment created between the technology and the goal of sustainability. The plan for Saudi  
330 Vision 2030 has been created on the basis of the goal of sustainability. The plan has been created  
331 on the basis of sustainability, not only from the point of view of the environment but also from  
332 the point of view of the quality of life and the efficiency of the government. (Saudi Arabia's  
333 commitment to spending efficiency is driving growth and building resilience, 2025) The  
334 implementation of the IoT technology on the basis of the consideration of smart mobility, waste  
335 management, etc. has been considered as an important factor for the contribution towards the  
336 goal of sustainability. The contribution has been considered from the point of view of  
337 sustainability, not only from the point of view of the environment but also from the point of view  
338 of the quality of life and the efficiency of the government. (Qurashi et al., 2025)  
339 Another major factor that has been emphasized through the above study is that the need for  
340 considering the role of governance and the level of institutional readiness for implementing the  
341 IoT technology-based smart cities has been a major factor. (Almulhim&Yigitcanlar, 2025) The  
342 implementation of IoT technology has been dependent on the level of institutional readiness as  
343 well as proper governance. (Albous et al., 2025) (Emerging Technologies Adoption Readiness in  
344 Government Agencies 2025, n.d.) The implementation of the IoT technology has been dependent  
345 on the level of institutional readiness as well as proper governance. The strategy for Vision 2030  
346 has been developed considering the objective of digital governance and cybersecurity. This has  
347 been an important addition to the objective of sustainability, not only from the point of view of  
348 the environment but also from the point of view of the quality of life as well as efficiency in  
349 government. (Saudi Arabia's cybersecurity strategy: Building a resilient digital future, 2025)  
350 Through the above study, it has been clearly emphasized that though the role of the Kingdom of  
351 Saudi Arabia has been a significant contribution to the implementation of IoT technology-based  
352 smart cities, the need for integration from different sectors has been a serious challenge.  
353 (Alamoudi et al., 2023) The implementation of the IoT technology has been a significant  
354 contribution towards the goal of sustainability, not only from the point of view of the  
355 environment but also from the point of view of the quality of life as well as efficiency in

356 government. (Alamoudi et al., 2023) The implementation of IoT technology has been a  
357 significant contribution towards the goal of sustainability, not only from the point of view of the  
358 environment but also from the point of view of the quality of life as well as efficiency in  
359 government. The cities that have been able to adopt a holistic and ecosystem-based approach in  
360 the development of smart cities are more likely to realize the sustainability benefits that are  
361 attached to the development of smart cities. Moreover, the discussion also shed light on the  
362 importance of conducting research and evaluation, which will prove to be beneficial in the  
363 development of smart cities in the future. Furthermore, the research also affirms the importance  
364 of incorporating IoT technology in the development of smart cities in Saudi Arabia. (Alqahtany,  
365 2025) Effects on Policy and Practice: It is important to note that the implications of the research  
366 are significant, especially in the formulation and implementation of policies, especially in the  
367 context of national development strategies. Based on the policy dimension, the implications of  
368 the research can be presented as follows:

369 The importance of the relevance of the alignment of long-term strategic visions and the  
370 regulatory mechanisms that are sector-specific in nature. In the future, it is essential to ensure  
371 that policymakers are able to focus on the adoption of an integrated approach in the formulation  
372 and implementation of policies. Moreover, the implications of the research also shed light on the  
373 importance of incorporating the adoption of policy guidelines in the formulation and  
374 implementation of policies in the future in order to realize strategic visions. Moreover, the  
375 implications of the research also shed light on the importance of incorporating the adoption of  
376 incentive-based policies in the formulation and implementation of policies in the future in order  
377 to realize strategic visions. From the practical point of view, it should also be noted that,  
378 according to the research, the involvement of the stakeholders should be taken as an operation  
379 rather than an additional task. This will be helpful in the improvement of the acceptability,  
380 efficiency, and sustainability of the projects. The evaluation aspect should also be taken as an  
381 operation. This will be helpful in the effective response to the dynamics of the economy,  
382 technology, and environment. In conclusion, according to the research findings, the policy and  
383 the practice, it should be noted that the decision-making process will be promoted. This will be  
384 helpful in striking of the harmony between the innovation, regulation, and sustainability, as  
385 highlighted in the various national development programs. This will be helpful in the promotion  
386 of the various national development programs in the country. In addition, it will also make the

387 various national development programs flexible and accountable while aligning them with the  
388 best practice standards.

389

## 390 **Conclusion and Future Research Directions**

391 The purpose of this research was to investigate the role of IoT technology in the development of  
392 sustainable smart cities from the strategic point of view of the Kingdom of Saudi Arabia's Vision  
393 2030. The results of the research have revealed that the role of IoT technology in the  
394 development of sustainable smart cities in the Kingdom of Saudi Arabia is significant in terms of  
395 integrating ICT with sustainable development goals, which is critical for the accomplishment of  
396 the objectives of the Kingdom of Saudi Arabia's Vision 2030 in terms of strategies related to the  
397 digital transformation of the Kingdom of Saudi Arabia and strategies related to the socio-  
398 economic diversification of the Kingdom of Saudi Arabia. (Leveraging advanced digital  
399 technologies for smart city development in Saudi Arabia: opportunities, challenges, and strategic  
400 pathways, 2023, pp. 1-12) It has also been found that the development of technology cannot be  
401 considered for the development of sustainability in smart cities. It has also been found that other  
402 factors can also be considered for the development of sustainability in smart cities. (The social  
403 sustainability of smart cities: a conceptual framework, 2022) It can be helpful for the maximum  
404 utilization of the potential of the smart cities developed through IoT technology. The strategic  
405 scenario of Saudi Arabia, including digital regulation, investment, and innovation, has been  
406 found to be of significant importance for the development of smart cities in Saudi Arabia. (Smart  
407 Cities as a Pathway to Sustainable Urbanism in the Arab World: A Case Analysis of Saudi  
408 Cities, 2023) It has also been found that it is very important for the development of smart cities  
409 in Saudi Arabia that the sustainability of all the factors should be ensured for the development of  
410 smart cities in Saudi Arabia. (Implementing Smart Sustainable Cities in Saudi Arabia: A  
411 Framework for Citizens' Participation towards SAUDI VISION 2030, 2023) It has been found  
412 that tremendous developments and progress have been achieved in the field of smart city  
413 development in Saudi Arabia. However, it has been considered important to explore some areas  
414 for the development of smart cities in Saudi Arabia. (Assessing the Progress of Smart Cities in  
415 Saudi Arabia, 2023) It is not easy, and future research can also be conducted for the development  
416 of knowledge about the impacts of the development of smart cities in Saudi Arabia through

417 IoTtechnology. This can provide deeper knowledge about the topic for the development of smart  
418 cities that can contribute to the achievement of Saudi Vision 2030. It has also been found that it  
419 is very much possible for future research to be conducted for the development of knowledge  
420 about the impacts of emerging technologies like AI, digital twins, blockchain, etc., in addition to  
421 IoT technology. This research can provide deeper knowledge about the topic for the development  
422 of smart cities in Saudi Arabia that can contribute to the achievement of Saudi Vision 2030.

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