Plagiarism Checker X - Report

Originality Assessment

10%

Overall Similarity

Date: Feb 16, 2026 (01:03 PM)
Matches: 665 / 6541 words
Sources: 3

Remarks: Low similarity detected, consider making necessary changes if needed.

Verify Report:
Scan this QR Code

1 Sustainable smart cities: the contribution of IoT-enabled technologies under 2 vision 2030 3 4 Abstract

5 The fast pace of urbanization has also contributed to an increase in the sustainability issues that 6 are being experienced in urban and city centers, which include energy, environmental, 7 transportation, and service delivery issues, among others. It is in this context that the 8 development of smart cities has been identified as an approach that seeks to achieve 9 sustainability in urban and city centers through the use of digital technologies, and in this regard, 10 IoT has been identified as an enabler that facilitates data acquisition, decision-making, and 11 optimization in urban and city centers, among others. This paper seeks to analyze the role that 12 IoT technology plays in creating smart and sustainable cities, with particular reference to Saudi 13 Vision 2030. This paper seeks to analyze, through an in-depth analysis of literature from all over 14 the world, the role that IoT technology plays in facilitating sustainability factors such as energy, 15 transportation, environmental, governance, and quality `1` of life in urban and city centers, with 16 particular reference to smart city development. This paper seeks to highlight that it is within this 17 context that smart city development, as an approach that seeks to achieve sustainability in urban 18 and city centers, that the strategic approach that `3` the Saudi government has taken towards digital 19 transformation and smart city development is at the core of their development agenda, as 20 highlighted within Saudi Vision 2030. The findings from this paper are that IoT technology has 21 an impact on efficiency, sustainability, and response in urban and city centers, and in this regard, 22 this paper seeks to reveal that the challenges that smart city development face are security, 23 interoperability, and governance, which are core factors that facilitate smart city development 24 and sustainability, and in this regard, this paper seeks to contribute to the existing literature on 25 smart city development and sustainability by proposing a conceptual approach towards smart city 26 development and sustainability, which is consistent with Saudi Vision 2030, with particular 27 reference to IoT technology. 28 29

Transformation; 31 Urban Development 32 33 Introduction 34 The problem of rapid urbanization has become [1] one of the most significant factors that define the 35 twenty-first century, and it has created a series of opportunities and challenges in relation to 36 sustainability and development. Urbanization has created a series of challenges in relation to 37 energy, transportation, environmental, and social issues, and the traditional management systems 38 of the city are not efficient in relation to the resolution of the aforementioned challenges, which 39 are causing problems like energy waste, transportation, environmental pollution, and a reduced 40 quality of life, among others. (Jeddah strategic approaches to sustainable urban development and 41 vision 2030 alignment, 2020, pp. 523-531) Therefore, the cities around the world are looking for 42 innovative solutions that [1] can support the development of sustainable development, and in this 43 regard, the development of smart cities has become a significant issue, and the concept of 44 sustainability has become a significant factor in the development of smart cities, which are based 45 on the use of digital technology and intelligent systems that can support the development of 46 sustainable development and increase the level of efficiency in their traditional management 47 systems. (Mutambik, 2023) Among the digital technologies that [1] can support the development of 48 smart cities, the Internet of Things (IoT) has become a significant factor in relation to 49 sustainability, and it has become a significant factor in the development of sustainable smart 50 cities in developed and emerging nations. (Park et al., 2018, p. 1388) 51 The IoT technologies are a set of technologies that are playing an important role in the 52 development of sustainable smart cities, and these are creating a range of opportunities in 53 relation to sustainability and development, and these are helping in the development of 54 sustainable cities that are able to optimize their systems, such as energy, transportation, 55 environmental, social, and many other systems, and these are creating a range of opportunities in 56 relation to sustainability and development. (Leveraging advanced digital technologies for smart 57 city development in Saudi Arabia: opportunities, challenges, and strategic pathways, 2023, pp.

158

12) Saudi Arabia has recognized the importance of the role that digital technology has to play in 59 resolving the challenges of sustainability while promoting the development goals of the nation. 60 Saudi Arabia has an ambitious agenda for the development of the nation up to 2030, as 61 highlighted in the Saudi Vision 2030, which includes the diversification of the economy, digital 62 transformation, quality of life, and many other areas. (Saudi Arabia's Vision 2030: Pioneering 63 Industrial Transformation and Economic Diversification, 2024) Smart city development is one of 64 the major components of the Saudi Vision 2030, as the Kingdom has invested heavily in the 65 development of smart cities. 3 (Saudi Arabia Smart Cities Market | 2019 – 2030 | Ken Research, 66 n.d.) Projects such as NEOM are an example of the commitment of the Saudi government to the 67 adoption of advanced technology, such as IoT, in the development of smart cities. (Leveraging 68 advanced digital technologies for 1 smart city development in Saudi Arabia: opportunities, 69 challenges, and strategic pathways, 2023)There are still some challenges that are associated with 70 the implementation of the IoT technology 2 in the development of smart cities, even though the 71 technology has been widely accepted in the development of smart cities. There is still 72 insufficient research regarding the implementation of the IoT technology in the development of 73 smart cities, since the issues of data security, sustainability, and other challenges that are 74 associated with the implementation of the IoT technology still exist. (Alotaibe, 2024, pp. 1410975 14118) Although various studies have been done regarding 2 the implementation of the IoT 76 technology in the development of smart cities, insufficient research has been done regarding the 77 implementation of the IoT technology in the context of the development goals of various nations, 78 such as the Saudi Vision 2030. (Alajmi, n.d.)In an attempt to bridge this gap, this research seeks 79 to contribute to the discussion of the value that can be added from IoT technologies in supporting 80 the development of sustainable dimensions of smart cities, as discussed in Vision 2030. A 81 conceptual approach for this research, which entails literature review, was adopted in an attempt 82 to identify the value

that can be added from IoT technologies in supporting the development of 83 sustainable dimensions of smart cities.The objectives of this research can be summarized as 84 follows: the general objective of this research is to analyze the value that can be added from IoT 85 technologies in supporting the development of sustainable dimensions of smart cities, as 86 discussed in Vision 2030. This research also seeks to analyze the value that can be added from 87 IoT technologies in supporting the development of sustainable dimensions of smart cities, 88 considering the strategic objectives of 2 the Saudi Vision 2030 for smart cities. This research also 89

seeks to identify the value that can be added from IoT technologies in supporting the 90 development of sustainable dimensions of smart cities, considering the challenges that can be 91 encountered in adopting IoT technologies in smart cities. This research contributes to the 92 academic literature in that it provides a framework for smart cities that aligns with the strategic 93 objectives of 2 the Saudi Vision 2030, considering the technological, sustainability, and strategic 94 dimensions of smart cities. 95 The rest of this paper is outlined as follows: in the second section of this paper, the literature 96 review of the concept of sustainable smart cities will be presented. Furthermore, the smart city 97 concept 2 under the Saudi Vision 2030 will be presented in the third section of this paper. 98 Moreover, the role of IoT technology in enhancing the sustainability of smart cities will be 99 analyzed in the fourth section of this paper. Furthermore, the discussion of the research findings 100 will be presented in the fifth section of this paper, while the conclusion of this research will be 101 presented in the last section of this paper. 102 103 Background and Literature Review 104 The complexity of urban systems has led to 1 the development of innovative strategies to create 105 smart and sustainable cities. Smart and sustainable cities are the product of the union of 106 sustainability and digital technology. Smart cities are cities that incorporate advanced 107 information and communication technology to improve the quality of services delivered to their 108 citizens. Sustainability, in this case, refers to the efficient and effective use of resources, the 109 environment, and

quality of life.The Internet of Things (IoT) has been identified as one of the 110 technologies that can be used to develop smart cities. IoT connects physical infrastructures 111 through sensors, software, and communication technology to enable real-time monitoring and 112 control of the infrastructures. From the literature, it is clear that IoT 1 has the potential to transform 113 the city to become more dynamic and adaptable.Research has been conducted to show the 114 potential of IoT to achieve environmental sustainability in smart cities. IoT-based energy 115 management systems have the potential to improve the supply and usage of electricity and eco116 friendly sources of energy. Smart grids, which are IoT-based, are also useful in identifying and 117 solving inefficiencies in the supply and usage of electricity. 118

IoT-based environmental monitoring systems are crucial in ensuring environmental sustainability 119 in smart cities.The second domain that the potential of IoT was explored is transportation and 120 mobility in smart cities. From the research conducted in this domain, it was identified that IoT121 based 1 intelligent transportation systems have the potential to be utilized in the development of 122 smart cities, as IoT has the potential to collect data and develop intelligent systems that can be 123 used to control transportation in smart cities, thereby improving transportation in smart cities and 124 making it more efficient and effective. From the research conducted in this domain, it can be 125 identified that the potential of IoT is directly linked to sustainability, as IoT 1 can be used to 126 reduce pollution in smart cities through the reduction of fuel consumption, as identified in the 127 research conducted in this domain. From the research conducted in this domain, it can be 128 identified that IoT can be used to achieve sustainability in the transportation domain in smart 129 cities. Apart from the potential applications mentioned above, IoT technology has been explored 130 in relation to smart governance within smart cities. In this case, smart governance within smart 131 cities can be improved through the application of IoT technology. In this case, IoT technology132 based waste management can be used for improving efficiency within smart cities, while smart 133 lighting

technologies can be used for improving lighting conditions as required within smart 134 cities. In this case, it can be seen that the potential applications are closely aligned with the 135 concept of social sustainability, as IoT can be used for 1 improving the quality of life within smart 136 cities. However, despite the fact that the above benefits of the application of Internet of Things 137 technology in the development of smart cities have been identified, there are some challenges 138 associated with the application and adoption of Internet of Things technology in the development 139 of smart cities, as identified in the existing literature. Some of the challenges include data 140 security and privacy, which is still a great challenge considering the amount of data that is 141 generated in the application 2 of Internet of Things technology in the development of smart cities. 142 Another challenge is the interoperability of different kinds 1 of Internet of Things technologies 143 with existing technology infrastructures.Based on the above public policies, the success of the 144 application of the Internet of Things technology in the development of smart cities is also 145 dependent not only on the level of development of the Internet of Things technology but also the 146 strategic aspect in terms of the national development policies. In fact, the integration of the 147 national sustainability policies and the digitalization policies 2 in the development of smart cities 148 in the application of the Internet of Things technology is more significant. It is therefore clear 149

  that nations have achieved more success in the development of smart cities in the application of 150 the Internet of Things technology than in the absence of the integration of the national 151 development policies. However, the literature with regard to the application and adoption of the 152 public policies 1 in the development and application of the Internet of Things technology in 153 specific regions of the Middle East is still limited.From the point of view of Saudi Arabia, 154 literature that has been written regarding the application and adoption of IoT technologies has 155 mainly concentrated on the development and application of smart city technologies. However, 156 little emphasis has been given to the overall role that IoT technologies can play towards the 157

sustainability goals that were set in Vision 2030. Although literature has been written regarding 158 the role that IoT technologies, such as NEOM, can play towards the development and application 159 1 of smart city technologies, little emphasis has been given to the overall conceptual role that IoT 160 technologies can play towards the sustainability goals that were set in Vision 2030. This, 161 therefore, highlights an important gap that needs to be filled regarding the application and 162 adoption of IoT technologies from the point of view of Vision 2030. 163 Conclusion 164 In conclusion, it is vital to appreciate the role that IoT technologies can play in the development 165 and application of smart cities along different dimensions. This 1 is due to the fact, as highlighted 166 in the literature, energy management, transportation, environmental protection, as well as 167 governance are some of the vital areas that have benefited significantly in terms of sustainability 168 due to the application and adoption of IoT technologies. The study, therefore, has relied on 169 literature regarding the application and adoption of IoT technologies for the development and 170 application of smart city technologies. This, therefore, underscores an important contribution that 171 has been made by this study towards the development of literature regarding the application and 172 adoption of IoT technologies for the development and application of smart city technologies. 173 174 175 176 Saudi Arabia's Vision 2030 and Smart City Strategy 177

It is submitted that the vision 2030 of Saudi Arabia can be considered an overarching vision that 178 aims to change the face of the nation, shatter the chains of oil addiction, diversify the economy 179 of the nation, and improve the lifestyle of the nation. It is also submitted that the digital 180 revolution and sustainability can be considered two of the pillars of the vision of the nation. It 181 can also be submitted that the smart city strategy can be considered a strategic vision that aims to 182 change the face of the cities of the nation, shatter the challenges of the nation, and improve the 183 lifestyle of the nation. It can also be submitted that the digital technology, especially the Internet 184 of Things, can be considered two of the components in realizing the vision of the nation, as 185 outlined

in the vision 2030 strategy of the nation. It can also be submitted that the vision 2030 186 framework of Saudi Arabia has also considered the development of vibrant cities, which can 187 compete in the region. The programs of the nation, which include the National Transformation 188 Program and 1 the Quality of Life Program, have taken into account the concept of smart cities, 189 which have the potential to develop smart infrastructure, digital government, and green planning 190 in the nation. It can be noted that the concept of smart cities has the potential to integrate 191 economic growth, social inclusion, and sustainability in the nation or the particular region in 192 question. It can also be noted that the Internet of Things technologies have the potential to 193 integrate with the concept of smart cities in the nation of Saudi Arabia, considering the potential 194 of these technologies to provide real-time visibility in the metropolitan spaces of the nation in 195 question. It can be noted that this has been considered a crucial factor in the municipal areas of 196 the nation, considering 1 the potential of these technologies to provide sustainability in the nation 197 in question, as seen in the Vision 2030 strategy of the nation in question. The Internet of Things 198 technologies, in particular, have provided the municipal areas of the nation with the potential to 199 monitor continuously the energy, transportation, environment, and spaces in the nation in 200 question. Some of the major projects that have been undertaken include the application of the 201 IoT technology as per the objectives and goals set by the government of Saudi Arabia. Some of 202 the projects that have been undertaken include 1 the development of smart energy systems, smart 203 transportation systems, smart services, smart environment systems, among others. The projects 204 that have been discussed above have shown that there is a change in the objectives of 205 infrastructure development in Saudi Arabia from conventional infrastructure development to 206 high-tech infrastructure development. The application of IoT technology in infrastructure 207 planning in Saudi Arabia has been carried out with the aim of developing infrastructure that is 208

strong enough to accommodate the population that is expected to develop in Saudi

Arabia in the 209 future. Looking at the application of IoT technology from the governance point of view, Vision 210 2030 has shown that 2 there is a need for the government of Saudi Arabia to develop a digital 211 government that can enhance transparency in the services delivered to the citizens of Saudi 212 Arabia. The application of IoT technology has enabled the government of Saudi Arabia to realize 213 this objective by assuring that there is an improvement in the availability of data in the services 214 offered to the 2 citizens of Saudi Arabia. This has enabled the government of Saudi Arabia to 215 develop its capacity by ensuring that IoT technology is integrated in governance. Smart 216 governance has enabled the government of Saudi Arabia to make well-informed decisions. IoT 217 technology-based smart cities, as outlined in the objectives and goals of Vision 2030, are made 218 possible by the ability of the government of Saudi Arabia to address the challenges that are likely 219 to arise during the application of IoT technology. The challenges that are likely to arise during 220 the application of IoT technology include regulation challenges, technology challenges, and 221 organizational challenges 1 that need to be addressed for sustainability benefits to be achieved. 222 It can, therefore, be concluded that Saudi Vision 2030 is creating an enabling environment for 223 the development of sustainable smart cities by enabling IoT technology. The relationship 224 between digital innovation alongside sustainability in Saudi Vision 2030 is creating a strategic 225 foundation for smart cities. This is important since it enables IoT technology to be part of 226 sustainability. 227

 Figure 1. Conceptual Framework of IoT-Enabled Sustainable Smart Cities under Saudi 228 Vision 2030 229 230 Description: 231 This conceptual framework illustrates the integration of IoT-enabled technologies with Saudi 232 Vision 2030 sustainability objectives. IoT applications (energy, transportation, environment, 233 governance, and public services) act as enablers that support key Vision 2030 pillars, resulting in 234 sustainable, resilient, and intelligent urban ecosystems. 235 Figure Components: 236 ☐ IoT Technologies (Sensors, Networks, Data Analytics) 237 ☐ Smart City Domains (Energy,

Mobility, Environment, Governance) 238 ☐ Vision 2030 Pillars (Sustainability, Digital Transformation, Quality of Life) 239 ☐ Outcomes (Efficient Services, Reduced Emissions, Urban Resilience) 240 241

Table 1. Alignment of IoT-Enabled Smart City Domains with Saudi Vision 2030 Objectives 242 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 Role of IoT-Enabled Technologies in the Development of Sustainable Smart 244 Cities 245 IoT technology has a pivotal role to play in the development of sustainable smart cities since it 246 has the potential to transform traditional physical and infrastructural systems into smart, 247 intelligent, and adaptable systems. Considering the Kingdom of Saudi Arabia's Vision 2030, IoT 248 technology is highly aligned with the vision and goals set by the Kingdom of Saudi Arabia, 249 especially regarding the efficiency of services, sustainability, and quality of life. One of the most 250 significant roles played by IoT technology in the development of smart cities is related to the 251 efficient and smart management of energy. The real-time monitoring of electricity consumption 252 in residential, commercial, and industrial sectors helps in more efficient and accurate predictions 253 regarding the demand and distribution of power. (Hadchity, 2024) The use of smart meters helps 254 in the real-time monitoring of power distribution, which is helpful in making operational 255 decisions regarding the power grid. (Hadchity, 2024) The use of IoT technology is highly aligned 256 with the Vision 2030 goals set by the Kingdom of Saudi Arabia, especially regarding the 257 sustainability of resources and the efficient use of resources. IoT technology has a significant 258 role to play in the development of smart transportation and mobility since IoT technology helps 259 in the development of smart transportation systems through the use of data collected from 260

various sources, such as traffic sensors, connected vehicles, and cameras. (Leveraging advanced 261

digital technologies for 1 smart city development in Saudi Arabia: opportunities, challenges, and 262 strategic pathways, 2024)In addition, IoT contributes to sustainability. IoT technology can be 263 used in the monitoring of the environment. In the context of the city, IoT technology can be used 264 to monitor the quality of air, the level of water use, the level of waste, and the level of noise 265 pollution. (Qurashi et al., 2025) The data collected will be used to predict the actions that will be 266 taken in the long term. For instance, IoT technology can be used in the management of water. 267 The technology will help minimize water waste by monitoring the level of water use. The 268 technology will be important in water-scarce regions. (Enhancing Sustainable Water 269 Management with IoT Sensors and Data Analytics, 2022) In addition, IoT technology makes the 270 development of smart governance possible. The technology will help the government improve its 271 decision-making skills. When the data collected by the various technologies deployed in the city 272 are integrated, the government will be in a better position to understand the various operations 273 within the various departments. This will pave the way 2 for the development of real-world 274 applications such as smart waste management, smart public lighting, and emergency response 275 coordination. (Qurashi et al., 2025) The health and safety of the public will also be improved 276 1 through the use of IoT technology. The technology will be used to monitor the health of patients 277 using connected medical devices. In addition, the technology will be used in surveillance to 278 improve public safety. (Smart Health Bracelet Equipped with AI and IoT Supports Security 279 Personnel, 2025) However, despite the benefits associated 1 with the use of IoT technology, the 280 full integration of the technology in Saudi Arabia's smart cities faces certain challenges. The 281 challenges arise due to the increased level of data privacy issues. The use of IoT technology 282 increases the level of cybersecurity risks. In addition, IoT technology faces compatibility 283 challenges. The IoT technology deployed

1 in the smart city comprises various technologies that 284 may not be compatible with each other. (Building Trust and Cybersecurity Awareness in Saudi 285 Arabia: Key Drivers of AI-Powered Smart Home Device Adoption, 2025) Strategically, the 286 sustainability of IoT technology in Saudi Arabia's smart cities will be determined by the level of 287 IoT technology integration with the policies and regulatory frameworks. Vision 2030 is moving 288 in the right direction regarding the regulation of the use of IoT technology in Saudi Arabia. The 289 regulation will improve the conditions necessary 2 for the development of IoT technology. 290 291

Figure 2: 292 293

A diagram showing the application domain of the IoT technology in different sectors of smart 294 cities 1 such as energy, transport, environment, governance, and services, and their contribution 295 towards sustainability in Vision 2030. 296 297 Conclusion 298 In conclusion, it is very clear from the discussion in this paper that the IoT technology has the 299 potential to significantly contribute towards the facilitation of the development of sustainable 300 smart cities, especially within the strategic framework of Saudi Vision 2030. The development of 301 smart cities through the application of IoT technology 1 has the potential to significantly contribute 302 to the facilitation of the development of sustainable smart cities in Saudi Arabia. (Hegazy, 2024) 303 Discussion 304 The findings from the research revealed that the application of IoT technology is crucial for the 305 improvement of the development of sustainable smart cities, especially within the strategic 306 framework of Saudi Vision 2030. (Leveraging advanced digital technologies for smart city 307 development in Saudi Arabia: opportunities, challenges, and strategic pathways, 2023, pp. 1-12) 308 The above paper has clearly demonstrated that the application of IoT technology plays a critical 309 role in the facilitation of the development of sustainable smart cities. This is because it has the 310 potential to significantly contribute towards the improvement of the efficiency and sustainability 311 of services in different sectors of smart

cities. (Alamoudi et al., 2023) The above finding from 312 the discussion is 2 in line with the emerging literature on smart cities, which has clearly 313 demonstrated the potential of digital technology towards the facilitation of the development of 314 sustainable smart cities. (Dahab et al., 2025)One of the most important things that this study has 315 learned regarding the role that IoT technology can play in supporting the development of a more 316 sustainable smart city is that IoT technology can function in an integrated manner. IoT 317 technology has been proven to function in an integrated manner. (Umar & Adria, 2023) This is 318 important, as it means that IoT technology can function as a basic component in the city. This is 319 particularly the case in relation to energy, transportation, the environment, and governance. This 320 is important in terms of supporting the development of a more sustainable city, particularly in the 321 context of Vision 2030. (Alamoudi et al., 2023) This is particularly the case, as dynamic 322 adaptability is basic to supporting the development of cities and economic diversity. (Assessing 323 the Progress of Smart Cities in Saudi Arabia, 2023) 324

The above explanation also points towards the fact that there needs to be an alignment created 325 between 2 the implementation of the IoT technology and the goal of sustainability. Technology is 326 one of the key factors that need to be considered for the implementation of the smart city project. 327 However, the sustainability of the project needs to be considered from the point of view of the 328 alignment created between the technology and the goal of sustainability. The plan for Saudi 329 Vision 2030 has been created 1 on the basis of the goal of sustainability. The plan has been created 330 on the basis of sustainability, not only from the point of view of the environment but also from 331 the point of view of the quality of life and the efficiency of the government. (Saudi Arabia's 332 commitment to spending efficiency is driving growth and building resilience, 2025) The 333 implementation of the IoT technology on the basis of the consideration of smart mobility, waste 334 management, etc. has been considered as an important factor for the contribution towards the 335 goal of sustainability. The contribution has been considered

from the point of view of 336 sustainability, not only from the point of view of the environment but also from the point of view 337 of 1 the quality of life and the efficiency of the government. (Qurashi et al., 2025) 338 Another major factor that has been emphasized through the above study is that the need for 339 considering the role of governance and the level of institutional readiness for implementing the 340 IoT technology-based smart cities has been a major factor. (Almulhim&Yigitcanlar, 2025) The 341 implementation of IoT technology has been dependent on the level of institutional readiness as 342 well as proper governance. (Albous et al., 2025) (Emerging Technologies Adoption Readiness in 343 Government Agencies 2025, n.d.) 2 The implementation of the IoT technology has been dependent 344 on the level of institutional readiness as well as proper governance. The strategy for Vision 2030 345 has been developed considering the objective of digital governance and cybersecurity. This has 346 been an important addition to the objective of sustainability, not only from the point of view of 347 the environment but also from the point of view of 1 the quality of life as well as efficiency in 348 government. (Saudi Arabia's cybersecurity strategy: Building a resilient digital future, 2025) 349 Through the above study, it has been clearly emphasized that though the role of the Kingdom of 350 Saudi Arabia has been a significant contribution to the implementation of IoT technology-based 351 smart cities, the need for integration from different sectors has been a serious challenge. 352 (Alamoudi et al., 2023) 2 The implementation of the IoT technology has been a significant 353 contribution towards the goal of sustainability, not only from the point of view of the 354 environment but also from the point of view of the quality of life as well as efficiency in 355

government. (Alamoudi et al., 2023) The implementation of IoT technology has been a 356 significant contribution towards the goal of sustainability, not only from the point of view of the 357 environment but also from the point of view of 1 the quality of life as well as efficiency in 358 government.The cities that have been able to adopt a holistic and ecosystem-based approach in 359 the development of smart cities are more likely to

realize the sustainability benefits that are 360 attached to the development of smart cities. Moreover, the discussion also shed light on the 361 importance of conducting research and evaluation, which will prove to be beneficial in the 362 development of smart cities in the future. Furthermore, the research also affirms the importance 363 of incorporating IoT technology 2 in the development of smart cities in Saudi Arabia. (Alqahtany, 364 2025) Effects on Policy and Practice: 1 It is important to note that the implications of the research 365 are significant, especially in the formulation and implementation of policies, especially in the 366 context of national development strategies. Based on the policy dimension, the implications of 367 the research can be presented as follows: 368 The importance of the relevance of the alignment of long-term strategic visions and the 369 regulatory mechanisms that are sector-specific in nature. In the future, 1 it is essential to ensure 370 that policymakers are able to focus on the adoption of an integrated approach in the formulation 371 and implementation of policies. Moreover, the implications of the research also shed light on the 372 importance of incorporating the adoption of policy guidelines in the formulation and 373 implementation of policies in the future in order to realize strategic visions. Moreover, the 374 implications of the research also shed light on the importance of incorporating the adoption of 375 incentive-based policies in the formulation and implementation of policies in the future in order 376 to realize strategic visions.From the practical point of view, it should also be noted that, 377 according to the research, the involvement of the stakeholders should be taken as an operation 378 rather than an additional task. This will be helpful in the improvement of the acceptability, 379 efficiency, and sustainability of the projects. The evaluation aspect should also be taken as an 380 operation. This will be helpful in the effective response to the dynamics of the economy, 381 technology, and environment. In conclusion, according to the research findings, the policy and 382 the practice, it should be noted that the decision-making process will be promoted. This will be 383 helpful in striking of the harmony between the innovation, regulation, and sustainability, as 384 highlighted in the various national development programs. This will be helpful in the promotion 385 of the various national

development programs in the country. In addition, it will also make the 386

various national development programs flexible and accountable while aligning them with the 387 best practice standards. 388 389 Conclusion and Future Research Directions 390 The purpose of this research was to investigate the role of IoT technology 2 in the development of 391 sustainable smart cities from the strategic point of view of the Kingdom of Saudi Arabia's Vision 392 2030. The results of the research have revealed that the role of IoT technology in the 393 development of sustainable smart cities in the Kingdom of Saudi Arabia is significant in terms of 394 integrating ICT with sustainable development goals, which is critical for the accomplishment of 395 the objectives of the Kingdom of Saudi Arabia's Vision 2030 in terms of strategies related to the 396 digital transformation of the Kingdom of Saudi Arabia and strategies related to the socio397 economic diversification of the Kingdom of Saudi Arabia. (Leveraging advanced digital 398 technologies for smart city development in Saudi Arabia: opportunities, challenges, and strategic 399 pathways, 2023, pp. 1-12)It has also been found that the development of technology cannot be 400 considered for the development of 1 sustainability in smart cities. It has also been found that other 401 factors can also be considered for the development of sustainability in smart cities. (The social 402 sustainability of smart cities: a conceptual framework, 2022) It can be helpful for the maximum 403 utilization of the potential of the smart cities developed through IoT technology. The strategic 404 scenario of Saudi Arabia, including digital regulation, investment, and innovation, has been 405 found to be of significant importance 2 for the development of smart cities in Saudi Arabia. (Smart 406 Cities as a Pathway to Sustainable Urbanism in the Arab World: A Case Analysis of Saudi 407 Cities, 2023) It has also been found that it is very important for the development of smart cities 408 in Saudi Arabia that the sustainability of all the factors should be ensured for the development of 409 smart cities in Saudi Arabia. (Implementing Smart Sustainable Cities in Saudi Arabia: A 410 Framework for Citizens' Participation towards SAUDI VISION 2030, 2023) It has been found 411 that tremendous developments

and progress have been achieved in the field of smart city 412 development in Saudi Arabia. However, it has been considered important to explore some areas 413 for the development of smart cities in Saudi Arabia. (Assessing the Progress of Smart Cities in 414 Saudi Arabia, 2023) It is not easy, and future research can also be conducted for the development 415 of knowledge about the impacts of the development of smart cities in Saudi Arabia through 416

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

422 References 423 1. Albino, V., Berardi, U., &Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, 424 and performance. Journal of Urban Technology, 22(1), 3–21. 425 2. Batty, M., et al. (2012). Smart cities of the future. European Physical Journal Special 426 Topics, 214, 481–518. 427 3. Bibri, S. E., &Krogstie, J. (2017). Smart sustainable cities of the future. Sustainable 428 Cities and Society, 29, 183–212. 429 4. Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. Journal of Urban 430 Technology, 18(2), 65–82. 431 5. Chourabi, H., et al. (2012). Understanding smart cities. Proceedings of the 45th Hawaii 432 International Conference on System Sciences. 433 6. Giffinger, R., et al. (2007). Smart cities: Ranking of European medium-sized cities. 434 Centre of Regional Science. 435 7. Hollands, R. G. (2008). Will the real smart city please stand up? City, 12(3), 303–320. 436 8. Kitchin, R. (2014). The real-time city? GeoJournal, 79, 1–14. 437 9. Komninos, N. (2013). Intelligent cities and globalisation of innovation networks. 438 Routledge. 439 10. Lee, J. H., Phaal, R., & Lee, S. H. (2013). An integrated service-device-technology 440 roadmap. Technological Forecasting and Social Change, 80(2), 286–306.

441 11. Lom, M., Pribyl, O., &Svitek, M. (2016). Industry 4.0 as a part of smart cities. IEEE 442 Smart Cities Symposium. 443 12. Nam, T., & Pardo, T. A. (2011). Conceptualizing smart city. Proceedings of the 12th 444 Annual Digital Government Research Conference. 445 13. Neirotti, P., et al. (2014). Current trends in smart city initiatives. Cities, 38, 25–36. 446

14. Santana, E. F. Z., et al. (2016). Software platforms for smart cities. IEEE Internet 447 Computing, 20(2), 18–25. 448 15. Townsend, A. M. (2013). Smart cities: Big data, civic hackers, and the quest for a new 449 utopia. Norton. 450 16. Zanella, A., et al. (2014). Internet of Things for smart cities. IEEE Internet of Things 451 Journal, 1(1), 22–32. 452 17. Zhou, Y., et al. (2019). Smart city development paths. Sustainable Cities and Society, 50, 453 101685. 454 18. Bibri, S. E. (2018). The IoT for smart sustainable cities. Journal of Cleaner Production, 455 176, 52–64. 456 19. Allam, Z., &Dhunny, Z. A. (2019). On big data, AI and smart cities. Cities, 89, 80–91. 457 20. Ahvenniemi, H., et al. (2017). What are the differences between smart and sustainable 458 cities? Cities, 60, 234–245. 459 21. Yigitcanlar, T., et al. (2018). Smart city policies revisited. Cities, 81, 145–157. 460 22. Angelidou, M. (2015). Smart cities: A conjuncture of four forces. Cities, 47, 95–106. 461 23. Mora, L., Bolici, R., & Deakin, M. (2017). The first two decades of smart-city research. 462 Cities, 70, 146–152. 463 24. United Nations. (2019). World urbanization prospects. UN DESA. 464 25. World Economic Forum. (2020). Smart cities and infrastructure. WEF Report. 465 466

Sources

1
https://www.mdpi.com/2624-6511/6/4/80
INTERNET
7%

2
https://www.alliedmarketresearch.com/saudi-arabia-smart-cities-market-A10247
INTERNET
3%

3
https://www.kenresearch.com/saudi-arabia-smart-cities-iot-infra-market
INTERNET
<1%

EXCLUDE CUSTOM MATCHES	ON
EXCLUDE QUOTES	OFF
EXCLUDE BIBLIOGRAPHY	OFF