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Harnessing Artificial Intelligence for Smart Urban Growth in the GCC



منتدى العالم
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Executive Summary

As cities across the globe face rapid urbanization and increasing resource constraints, governments and businesses are turning to artificial intelligence (AI) and other emerging technologies to develop sustainable “smart city” solutions. This policy report examines the integration of AI into smart city initiatives in the Gulf Cooperation Council (GCC) region, with a particular focus on Oman and Saudi Arabia.

This study seeks to investigate public perceptions of smart city dimensions and assess how AI is currently shaping urban services such as mobility, governance, healthcare, environment, and economic systems. Using a survey-based, quantitative research method, data was collected from 49 respondents across Oman and Saudi Arabia. A random sampling technique was used in the data collection, and the findings offer an empirical analysis of how each GCC country is adopting AI in their smart city strategies.

The results show that Saudi Arabia leads in AI integration across key domains including autonomous vehicles, digital governance, and real-time decision-making, aligning with the country’s Vision 2030 goals. Oman, while lagging in some areas, demonstrates significant potential for AI adoption if it increases investment in digital infrastructure, governance, and public-private partnerships. This report also identifies key barriers to AI deployment in the GCC region, including ethical concerns, limited AI expertise, regulatory gaps, and infrastructure challenges. Regarding AI privacy and ethics, Saudi Arabia demonstrates greater skepticism, whereas Oman’s comparatively lower degree of skepticism likely reflects its more limited adoption and awareness of AI.

As regional and international interest in smart city development continues to grow, the GCC has a unique opportunity to lead in the responsible deployment of AI technologies. This report aims to inform that process by offering evidence-based policy recommendations grounded in the local context. It also lays the groundwork for cross-border collaboration, capacity building, and regulatory innovation necessary to realize the full potential of smart cities in the Gulf region. Although the current findings rely on limited data samples, they provide actionable insights for policymakers aiming to harness AI for smarter, more sustainable urban development. This research also underscores the need for inclusive, ethical, and well-regulated approaches to ensure AI delivers equitable and resilient outcomes in GCC cities.

Policy Recommendations

To strengthen AI integration in smart cities and promote sustainable urban development across the GCC region, this study recommends the following actions:

1. Invest in Smart Infrastructure and AI Services

- Upgrade urban infrastructure with AI-compatible systems, including IoT networks, cloud platforms, and data-driven city operations.
- Deploy AI in key sectors such as transportation, governance, environment, healthcare, and smart utilities.
- Allocate government funding for AI research, smart city pilots, and tech incubation hubs.
- Foster public-private partnerships (PPPs) through incentives, co-financing models, and innovation grants.

2. Establish Robust AI Governance and Ethical Frameworks

- Develop national AI strategies with clear regulations on data privacy, intellectual property, and algorithmic accountability.
- Implement regulatory frameworks ensuring data protection and algorithmic explainability in AI systems.
- Mandate ethical impact assessments for AI deployed in public services to mitigate risks and biases.
- Ensure that AI systems are transparent and fair, with mechanisms for redress in case of harm or discrimination.
- Promote public-private collaboration to align AI governance with international best practices while addressing local needs.

3. Address AI Skill Gaps and Build Human Capital

- Launch AI education and training programs in universities, technical institutes, and public service academies.

- Promote reskilling and upskilling programs to create a local workforce capable of supporting AI development and integration into smart cities.
- Provide incentives for research and development and academic partnerships to foster innovation and local expertise.
- Establish technical institutions specifically for delivering courses and programs in AI and data sciences.

4. Enhance Data Management, Data Privacy, and Interoperability

- Establish national open-data platforms to support AI model training, transparency, and collaboration.
- Standardize data collection and sharing protocols within each Gulf nation and across the GCC as a whole.
- Enforce strict data protection laws and cybersecurity protocols to protect citizens' data in smart city environments.
- Implement AI-based cybersecurity systems to detect and mitigate threats in real-time.

5. Accelerate Regional Collaboration and Standardization

- Establish a GCC-wide task force and innovation hub for smart cities and AI technologies.
- Share best practices and case studies between countries to accelerate learning and adoption.
- Coordinate cross-border investments and pilot projects to achieve economies of scale and joint innovation.
- Launch joint GCC initiatives for AI integration into climate tech, health tech, mobility, and infrastructure.

- Develop shared standards and policies to streamline AI adoption and ensure interoperability.
- Facilitate cross-border collaboration on AI use cases, challenges, and regulatory best practices.

6. Promote Public Awareness, Engagement, and Trust in AI

- Conduct public awareness and education campaigns to improve understanding of AI benefits and concerns—such as ethics, data privacy, and job displacement—in daily life.
- Involve citizens in co-designing AI-based services including mobility, healthcare, and public safety.
- Establish mechanisms for submitting feedback and addressing grievances related to AI-enabled services.
- Foster civic engagement through participatory platforms for smart city planning and monitoring such as hosting a “hackathon” event.

7. Monitor and Evaluate AI Impact

- Develop AI evaluation frameworks to systematically assess performance, risks, and societal outcomes of smart city AI applications.
- Establish key performance indicators (KPIs) to measure AI effectiveness across efficiency, equity, privacy, and economic impact.
- Implement continuous monitoring systems to detect unintended consequences or biases in real-world AI deployments.
- Create feedback loops where evaluation findings directly inform policy updates, technology refinements, and operational improvements.
- Publish transparent impact reports to maintain public accountability and build trust in AI systems.

Introduction

The extraordinary increase in urbanization in the 21st century has created a wide range of problems for governments, urban planners, and political leaders. Cities are facing mounting pressures to offer higher standards of living, sustainable infrastructure, and effective public services to their rapidly expanding populations. The United Nations' Department of Economic and Social Affairs projects that by 2100 there will be 11.2 billion people on the planet, and by 2050 the population is expected to reach 9.8 billion people, with 64.8 percent of them estimated to reside in cities. To keep cities livable and resilient in the face of this dramatic population upheaval, innovative approaches to urban design and governance are of the utmost importance.

In response to these unprecedented developments, many nations have embraced the concept of "smart cities." The Internet of Things (IoT), cloud computing, AI, and big data analytics are some of the cutting-edge technologies that smart cities use to improve decision-making, optimize resource consumption, and improve urban functionality. Additionally, cities can leverage these technologies to enhance service delivery, reduce environmental impact, monitor and manage infrastructure in real time, and promote more inclusive and transparent governance through increased engagement with citizens.

A number of technologically advanced cities around the world, such as Barcelona, Singapore, and Dubai, have shown how technology-driven urban models can help address enduring problems like traffic, pollution, and ineffective public services. These urban ecosystems now include AI-assisted healthcare systems, smart grids, intelligent waste management, and smart mobility solutions. These technological adaptations reflect a growing consensus

that digital transformation is no longer a choice but a necessary facet for sustainable urban development.

The development of smart cities and the use of emerging technologies in the GCC is directly related to national modernization plans across the region: Bahrain's Economic Vision 2030, Qatar's National Vision 2030, Saudi Arabia's Vision 2030, the United Arab Emirates' Vision 2031, Kuwait's Vision 2035, and Oman's Vision 2040. These frameworks highlight digital transformation, sustainable growth, and economic diversification as critical pillars for national development. The GCC's respective smart city programs seek to utilize technological innovation to increase economic competitiveness, refine public services, and improve government efficiency. Nevertheless, the level of acceptance and rate of implementation vary widely throughout the region, with some nations advancing more rapidly than others.

With an emphasis on the Sultanate of Oman and the Kingdom of Saudi Arabia, we assessed the extent to which AI is incorporated into smart city programs throughout the GCC region. Our investigation raised two major questions: (1) What are the key dimensions of smart cities in the GCC, and how do citizens perceive them; and (2) How is AI currently impacting smart cities in the GCC, and what is its future potential?

The research analyzes public views, essential areas of AI implementation, challenges, and policy gaps. In order to develop evidence-based policies that promote responsible, scalable, and sustainable AI integration in smart cities throughout the region, this case study intends to provide policymakers, urban planners, and stakeholders practical insights based on an empirical assessment of primary data. The study advances a more comprehensive understand-

ing of regional dynamics, best practices, and cooperative prospects by providing a comparative examination of two GCC nations at varying phases of smart city development and AI integration. Ultimately, the study will act as a foundational step toward long-term strategy, planning, and informed decision-making for AI-driven urban innovation in the Gulf.

Background and Significance

Conventional approaches to urban planning and administration are becoming inadequate as cities grow and populations rise. Therefore, a paradigm shift in the planning, management, and operation of cities is necessary—particularly due to factors such as growing energy use, traffic congestion, environmental damage, and increased pressure on regional healthcare and education systems. In response to these mounting challenges associated with rapid urbanization, resource scarcity, and the increasing complexity of public service delivery, the “smart city” has emerged.

Smart cities seek to improve the efficiency, sustainability, and livability of metropolitan areas through the use of digital technologies. Smart mobility, smart governance, smart economy, smart lifestyle, and smart environment are some of the domains that are included in the smart city framework. AI applications help improve these domains by providing real-time decision-making, process automation, predictive analytics, and more responsive public services. In particular, AI is essential for improving strategic planning, citizen engagement, and operational efficiency as urban centers become more data-driven. Cities may use AI to automate procedures, analyze large databases, forecast trends, and facilitate evidence-based, real-time policymaking. While AI applications have the ability to completely transform the way urban systems operate—from improving security and healthcare delivery to controlling traffic flow and energy use—

they are accompanied by significant concerns. Issues such as explainability, data privacy, ethical use, and legal compliance require thorough governance and active stakeholder participation.

Smart city projects are becoming important parts of national development plans in the GCC region. As part of their long-term plans for economic diversification and sustainability, nations like Saudi Arabia and the United Arab Emirates have started large-scale smart city initiatives like NEOM and Masdar City. These projects underscore the growing consensus that AI and associated technologies are essential not only for solving environmental and economic issues, but also for increasing international competitiveness.

This study is significant in that it provides insights for the application of AI in GCC smart city frameworks, specifically in Oman and Saudi Arabia. Based on empirical data collection and analysis from regional stakeholders, this report identifies:

1. Key areas where AI is making an impact, such as autonomous vehicles, smart resource management, and healthcare analytics.
2. Gaps in policy and infrastructure that hinder wider adoption, as well as public perceptions and awareness that influence the success of AI deployment.
3. Common challenges across the region, such as data privacy, lack of AI expertise, energy consumption, and ethical governance.

Additionally, this report offers insights into how AI can improve quality of life, bolster economic resilience, and promote long-term sustainability in the region. Reducing urban inequality, improving service delivery in underserved and distant regions, and advancing climate adaptation are all possible with effective AI integration.

Crucially, in order to guarantee that AI makes a constructive contribution to inclusive and responsible urban development, these advantages must be weighed

against robust ethical frameworks, cybersecurity safeguards, and open governance procedures.

Research and Design Methods

In this study, we used a quantitative research approach and random data sampling technique. An online survey was used to collect data from GCC nationals and residents. The survey questions were carefully crafted to guarantee that they collected quantifiable and policy-relevant information. The five main facets of smart cities included in the survey were:

- Smart mobility (autonomous transportation, traffic optimization)
- Smart governance (AI-driven public services, digital administration)
- Smart environment (renewable energy integration, waste management)
- Smart living (digital healthcare, smart homes)
- Smart economy (industry 4.0 technologies, digital finance)

The survey also evaluated present and future AI applications across key industries: intelligent advertising, healthcare (e.g., disease prediction), real-time decision-making (e.g., earthquake response and urban planning), and disaster prediction (e.g., flood monitoring and weather forecasting). In order to determine public acceptance and concerns, respondents were asked how they believed AI might affect these areas. Additionally, the survey assessed the main obstacles to implementing AI, such as ethical considerations, questionable AI decision-making, risks to data privacy and security, high energy consumption of AI systems, and governance obstacles (e.g., intellectual property issues and regulatory compliance).

This methodology ensured that the information gathered maintained scien-

tific rigor and relevance, providing policymakers with useful insights for future decision-making.

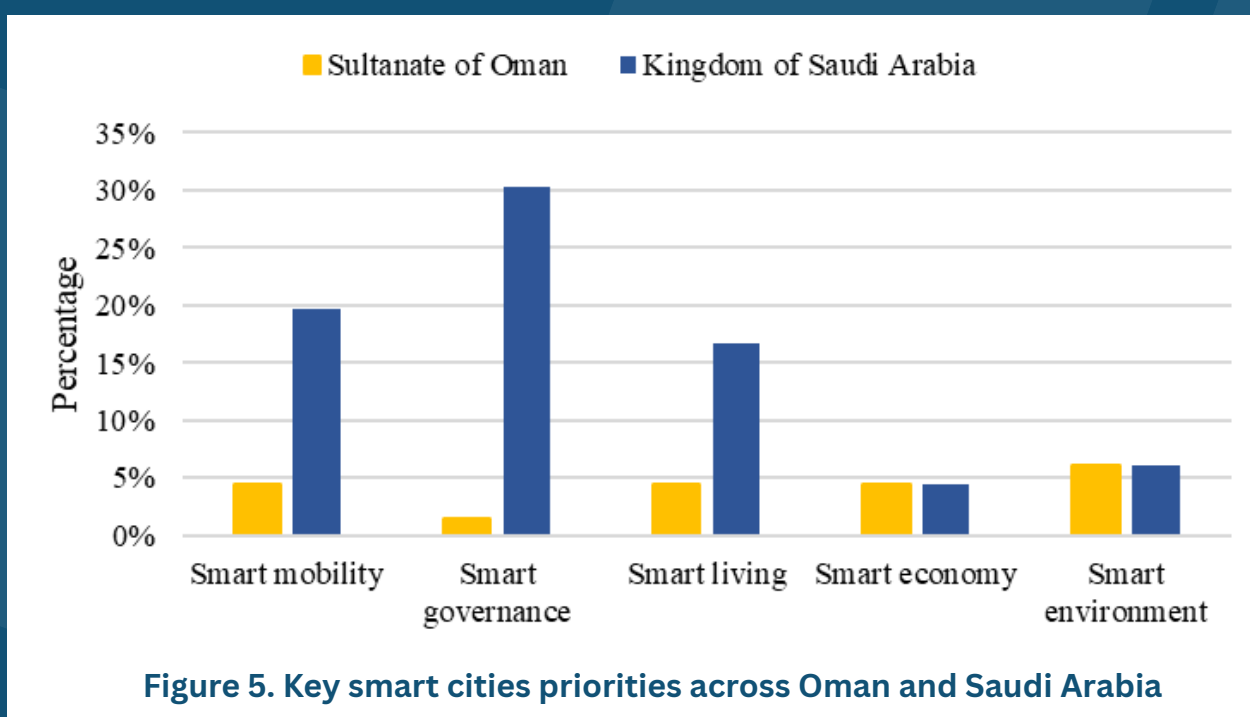
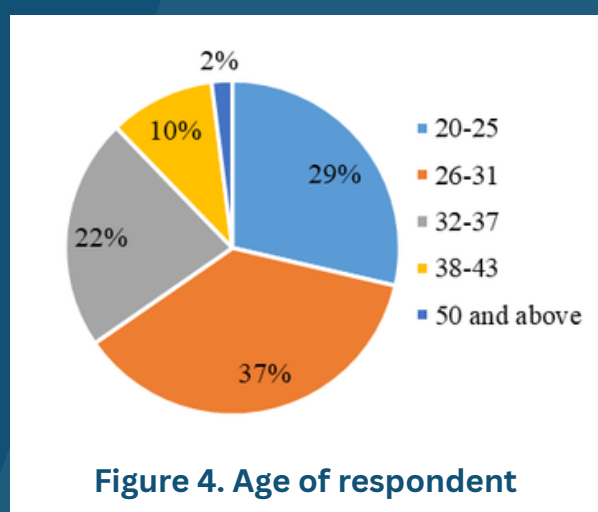
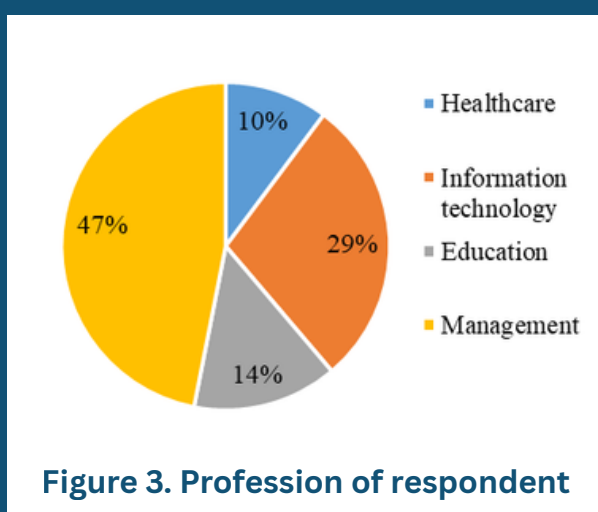
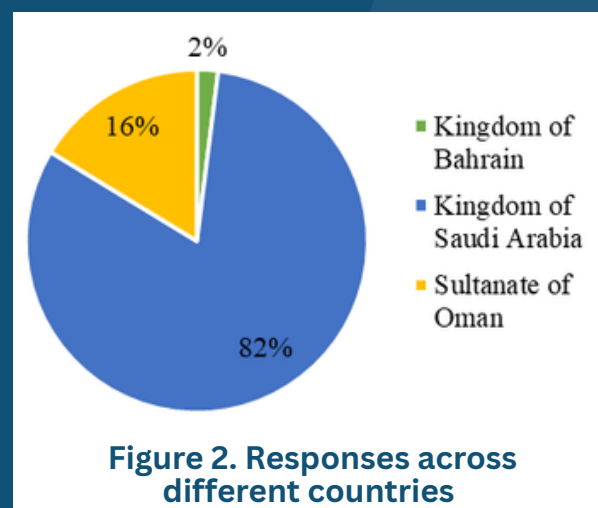
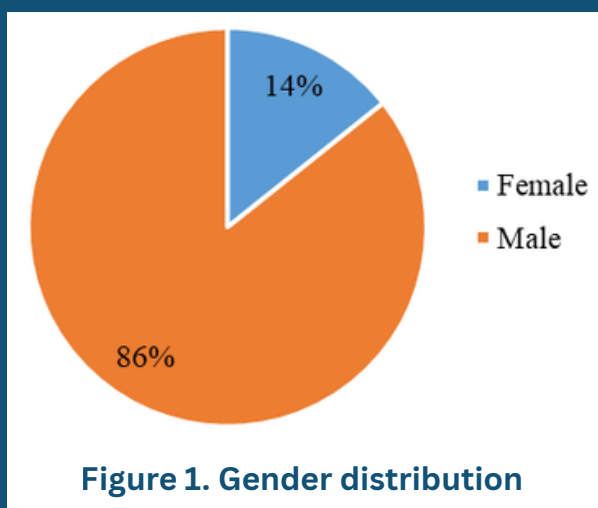
The survey's design and analysis were openly described to improve reliability and reproducibility. 56 replies were gathered, and 49 valid responses were kept for analysis after duplicate and incomplete entries were eliminated. The study's conclusions were also cross-checked against previous research on AI and smart cities to ensure consistency and boost the findings' legitimacy.

Demographic Analysis

The survey captured responses from a diverse group of participants, most of whom were based in Saudi Arabia (82 percent), followed by Oman (16 percent), with a small group from Bahrain (2 percent). The majority of respondents (88 percent) were between 20 and 37 years old, with the age groups of 26–31 (37 percent) and 20–25 (29 percent) being the most represented. In terms of gender, 86 percent of the sample were male and 14 percent were female. Regarding professional background, 47 percent were employed in management roles, 29 percent in information technology, 14 percent were instructors, and 10 percent worked in healthcare. This demographic distribution reflects a young, professionally active population, particularly in sectors critical to smart city development, such as IT and management. Figures 1 to 4 (below) show the demographics of the respondents.

Smart City Priorities

The survey results reveal a clear differ-



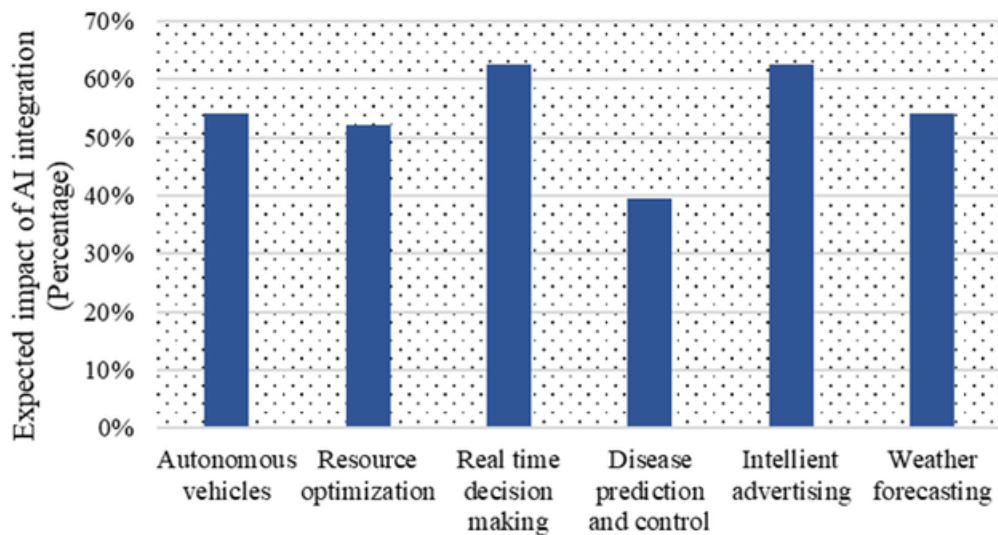


Figure 6. Expected impact of AI integration in the Kingdom of Saudi Arabia

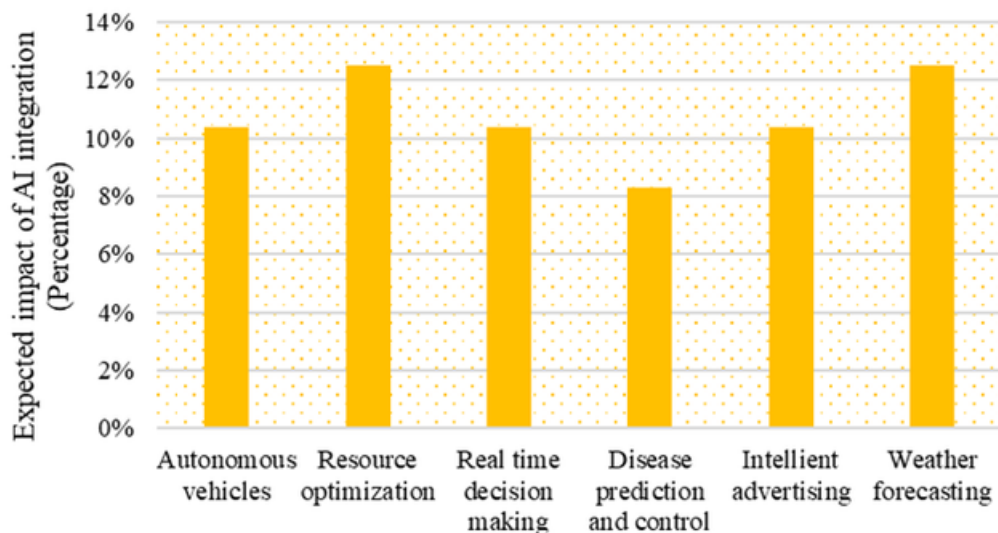


Figure 7. Expected impact of AI integration in the Sultanate of Oman

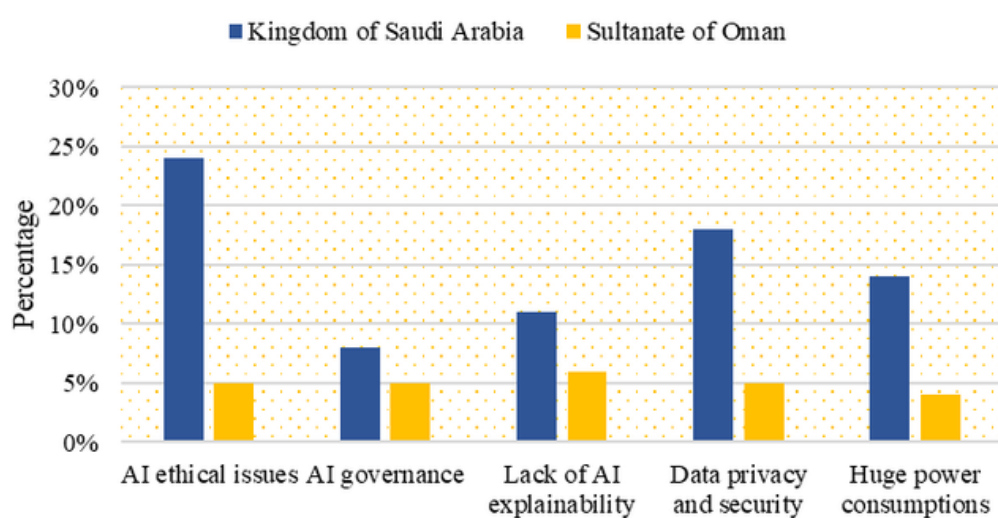


Figure 8. Challenges to AI integration in GCC region

ence in smart city development priorities between Saudi Arabia and Oman. Saudi Arabia demonstrates strong leadership in smart governance (30 percent) and smart mobility (20 percent), reflecting major investments in digital public services and intelligent transport systems. In contrast, Oman shows lower engagement across most dimensions yet maintains equal emphasis with Saudi Arabia on smart economy (5 percent) and smart environment (6 percent). These findings suggest that while Saudi Arabia is advancing rapidly in its digital transformation agenda, Oman is progressing more cautiously, focusing on sustainability and economic innovation as shared priorities. Figure 5 (above) shows key smart cities priorities across Oman and Saudi Arabia.

Integration of AI in Smart Cities

We found a significant disparity in AI integration across Saudi Arabia and Oman. Saudi Arabia leads in AI adoption across multiple domains. The substantial impact includes autonomous vehicles (54 percent), real-time decision-making (63 percent), and intelligent advertising and promotion (63 percent). These figures reflect the country's strong push toward AI-driven governance and services. In contrast, Oman's AI integration remains limited, with less than or equal to 10 percent, suggesting early-stage adoption and limited infrastructure or investment in smart AI systems. Figures 6 and 7 (above) show the expected impact of AI integration across various areas in Saudi Arabia and Oman.

Challenges to AI Integration in Smart Cities

We observed significant concerns regarding AI deployment in smart city initiatives, particularly in Saudi Arabia where respondents identify ethical issues (24 percent), data privacy (18 percent), and lack of explainability (11 percent) as the top barriers. In comparison, Oman reports these challenges at considerably

lower levels—6 percent for ethical issues and 5 percent each for data privacy and explainability—reflecting both the nascent stage of AI adoption and possibly lower public awareness of these issues. Addressing these concerns will be critical to building trust and ensuring the responsible integration of AI technologies in smart city frameworks. Figure 8 (above) shows the AI integration challenges in the Kingdom of Saudi Arabia and the Sultanate of Oman.

There are notable regional differences in the rate of smart city development, and more specifically, AI integration. Some Gulf states, such as Oman, are still in the early phases of implementation, whereas Saudi Arabia has achieved significant advancements in fields like digital government, intelligent transportation systems, and AI-enabled healthcare. Table 1 (below) shows the summary of key AI integration challenges in Saudi Arabia and Oman.

Table 1. Summary of key AI integration challenges in Saudi Arabia and Oman

Challenge	Observations
Infrastructure and technology readiness	Both countries face issues integrating AI into existing infrastructure, IoT networks, and cloud systems.
Availability and accessibility of quality data	Saudi Arabia has better data infrastructure, while Oman struggles with data collection, sharing, and processing.
Data security and privacy concerns	Saudi Arabia's AI systems handle more complex data, leading to higher cybersecurity risks. Oman's challenge is less severe but still present.
Limited AI expertise and skill gaps	Both lack AI specialists, software engineers, and data scientists, requiring more AI education and workforce training.
Regulations and ethical AI governance	Saudi Arabia has more structured AI policies, while Oman faces greater legal and ethical uncertainties.
AI investment and financial support	Saudi Arabia has stronger AI funding, while Oman faces limited AI project investments.

Implications

Saudi Arabia should concentrate on increasing AI integration, especially in the smart transportation and governance sectors, in order to promote the development of smart cities. At the same time, it must address ethical issues to boost public confidence. To accelerate the adoption of AI in key sectors, Oman, on the other hand, must make significant investments in digital infrastructure and capacity building. Additionally, encouraging cooperation among GCC nations can promote collective progress, strengthening AI-driven projects pertaining to sustainability and the smart economy. Table 2 (below) summarizes policy recommendations.

Recommendations for the Kingdom of Saudi Arabia

Expand AI integration in smart mobility and governance

- Invest in AI-driven public transport, including autonomous vehicles and smart traffic systems.
- Use AI platforms to improve government services and administrative efficiency.
- Enhance transparency and citizen engagement through AI technologies.

Address ethical concerns and data privacy

- Create clear guidelines and regulations for ethical AI use.
- Raise public awareness about AI and data privacy through targeted campaigns.
- Set up an independent body to monitor AI ethics and data protection practices.

Recommendations for the Sultanate of Oman

Invest in digital infrastructure

- Upgrade broadband networks and cloud computing systems to support AI adoption.
- Promote public-private partnerships to speed up AI technology deployment across sectors.

Capacity building and AI literacy

- Launch educational programs and workshops to enhance AI skills among government staff, businesses, and the public.
- Encourage universities and technical institutes to develop AI-related curricula and research centers.

Recommendations for the GCC

Create a regional AI framework

- Develop a unified GCC-wide AI policymaking body to align regulations, ethics, and data-sharing standards.
- Support joint funding initiatives for cross-border AI research and smart city pilot projects.

Promote AI-driven sustainability and smart economy initiatives

- Exchange best practices and technologies for AI use in energy efficiency, waste management, and water conservation.
- Develop regional innovation hubs and incubators to support start-ups focusing on AI-enabled smart economy solutions.

Table 2. Summary of policy recommendations

Country	Key Focus Area	Key Recommendations
Saudi Arabia	1. Smart mobility and governance 2. Ethics and data privacy	• Expand self-driving cars and smart traffic systems • Use AI to improve government services • Create clear AI ethics rules • Educate citizens on data safety • Establish an AI ethics watchdog
Oman	1. Digital infrastructure 2. AI education	• Improve internet and cloud systems • Partner with private sector for AI projects • Launch AI training programs • Add AI courses to public universities
Entire GCC	1. Regional AI cooperation 2. Green technology	• Create shared AI rules for all GCC countries • Cooperate on AI research • Share eco-friendly AI solutions • Support new AI businesses

Conclusion

This study not only highlights how AI has the potential to revolutionize smart cities throughout the GCC but also draws attention to the disparities in development and the challenges that Saudi Arabia and Oman face. According to the findings, Oman lags behind in the adoption of AI, requiring significant investments in digital infrastructure and regulatory frameworks, whereas Saudi Arabia has made significant advancements in smart governance and mobility, in line with its Vision 2030 goals. To fully reap the benefits of AI, both countries

must overcome common obstacles such as skill shortages, data privacy issues, and legislative constraints.

This study has broader implications for the GCC region, providing guidance on how to navigate AI-driven urban development and its potential challenges. Key findings highlight the need for:

- Strategic investments in AI infrastructure, particularly in Oman, to bridge existing gaps in smart city adoption.

- Regional collaboration to foster knowledge exchange, joint innovation, and standardized ethical guidelines for AI deployment.
- Policy reinforcement to mitigate risks related to data security, algorithmic transparency, and public trust in AI systems.

Although this study offers useful information, its shortcomings, such as its limited sample size and exclusive emphasis on two GCC nations, offer prospects for further investigation. Deeper, more broadly applicable results might be obtained by using mixed-methods approaches and broadening the scope to include all GCC countries. Finally, in order to ensure that urban transformation is inclusive, sustainable, and robust in the face of rapid global change, the successful integration of AI in smart cities ultimately depends on balancing ethical governance with technological innovation.

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