

Emerging Trends in Digital Infrastructure and Their Connection to Saudi Vision 2030

Syed Imran Raza

Research Scholar, Institute Universitaire du Bénin, IUB

doi.org/10.64643/IJIRT12I9-191847-459

Abstract- Vision 2030 highlights digital infrastructure as key to Saudi Arabia's economic growth and digital transformation. Technologies like 5G, cloud computing, artificial intelligence, the Internet of Things, and smart data centers play a major role in reaching these goals. This analysis looks at how these technologies help achieve objectives.

This study looks at recent research, industry reports, and government initiatives to find out the chances, challenges, and main areas where digital technologies make a difference, like smart cities, e-government, and digital health. The study found that when strong infrastructure is paired with good policies and governance, it helps improve the use of technology, makes operations more efficient, and increases the involvement of citizens are. The study points out key factors that lead to success, like strong cybersecurity, improving digital skills, and having good regulations. Understanding these factors gives important guidance to decision-makers, tech companies, and city planners on how to build a country that is both digitally strong and economically varied. The study points out key factors that lead to success, like strong cybersecurity, improving digital skills, and having good regulations. Understanding these factors gives policymakers, tech companies, and planners important information to build a country that is both digitally strong and economically varied.

Keywords - Digital Infrastructure, 5G Networks, Cloud Computing, Internet of Things (IoT), Artificial Intelligence (AI), Saudi Vision 2030, Smart Cities, E-Government.

I.INTRODUCTION

Digital systems are very important in today's economies, societies, and progress in technology. Many countries are spending a lot of money on digital networks, cloud computing, the Internet of Things (IoT), and artificial intelligence (AI) to make communication better, work more efficiently, and provide excellent digital services. A solid digital

infrastructure helps governments, businesses, healthcare systems, schools, and people communicate and work together better. As digital technology changes quickly, countries that carefully invest in modern infrastructure are more likely to grow steadily, draw in foreign money, and stay ahead in the world's digital market.

In Saudi Arabia, the need for strong digital infrastructure has become much more important because of Vision 2030, which is a national plan aimed at making the economy more varied and using more modern technology. Vision 2030 wants to cut down on relying too much on money from oil and move towards an economy that is based on knowledge, innovation, and using digital technology. The plan focuses on building smart cities, improving government services online, and using new technologies in important areas like healthcare, schools, moving people around, and providing electricity. It's important to connect the growth of digital systems with these goals to keep the economy strong and the country competitive over time.

New trends are changing how Saudi Arabia builds its digital systems. These include making 5G networks bigger, using cloud computing more, using AI-powered tools more often, and putting a lot of IoT devices across the country. Fifth-generation, or 5G, networks offer extremely fast internet speeds, very low delay in data transfer, and the ability to connect a huge number of devices at the same time. These features help with complex tasks such as driverless vehicles, medical care from a distance, and intelligent manufacturing plants. Cloud computing gives businesses flexible and cost-effective ways to save data, handle tasks, and run software, making it easier for them to work efficiently and adjust quickly to changes AI tools help with predicting future trends, making smart decisions, and doing tasks

automatically. At the same time, IoT devices allow for real-time tracking and managing of city systems, energy use, and industrial operations.

Smart city development is one of the most important uses of advanced digital infrastructure in Saudi Arabia. Smart cities are built to make operations run more smoothly, help protect the environment, and give people better services. Smart cities use connected digital systems to control traffic, use energy more efficiently, make public transport better, and increase safety for everyone. Big projects like NEOM show the country's dedication to using modern digital technologies in designing cities. These projects use real-time data gathering, smart analytics powered by AI, and internet-connected monitoring tools to enhance the quality of life, draw in investments, and boost economic growth through innovation. Another important part of building digital infrastructure is growing e-government services. Digital government platforms are designed to make public administration more efficient, clear, and easy to access for everyone. Saudi Arabia has launched several programs to make government processes easier, allow people to do transactions online, and improve the way services are provided using digital tools. Fast internet, managing data through the cloud, and using smart tools powered by AI are key to making these projects work.

Healthcare and education are also seeing big improvements because of better digital infrastructure. Digital health tools, telemedicine services, and AI systems that help with diagnosis all need strong internet connections and safe ways to handle patient data. 5G networks allow doctors to consult with patients from a distance, keep track of patients' health in real time, and send medical information quickly, which helps people get better healthcare, especially those living in faraway places. Educational institutions are starting to use more digital tools for online learning, virtual classrooms, and personalized education with the help of AI, which helps in developing human skills and preparing people for the workforce. Even though there are many chances, there are still several difficulties to deal with, like the risk of cyber-attacks, expensive costs to set things up, tricky problems when connecting different systems, and the need for workers who know a lot about digital technology. Building strong digital systems is still very important for Saudi Arabia's future growth, new

ideas, and ability to compete with other countries around the world.

II.LITERATURE REVIEW

Digital infrastructure is seen as a key base for today's economic growth, advances in technology, and how people interact with society. It helps with clear communication, making decisions based on data, and encouraging new ideas in various areas like government, industry, healthcare, and education. In Saudi Arabia, the development of digital systems has picked up speed in recent years, largely due to Vision 2030. This plan is designed to spread out the economy, cut down on reliance on oil money, and encourage a society that values knowledge and technology. This literature review looks at important parts of digital infrastructure, such as 5G networks, cloud computing, artificial intelligence, the Internet of Things, and smart city projects.

2.1 5G Networks and Connectivity

5G technology is a big step forward in how we use mobile networks, allowing faster internet speeds, quicker response times, and the capability to link many devices at the same time. According to Pawar et al. In 2024, these features help with more complex uses like self-driving vehicles, medical care from a distance, smart energy networks, and automated factories. The literature shows that 5G is very important for digital transformation, enabling fast communication and smooth connection of digital services.

The expansion of 5G networks in Saudi Arabia enhances digital government services and supports smart city initiatives. Fu (2025) states that 5G allows for AI-based traffic management, IoT-based infrastructure monitoring, and public platforms that use cloud technology. According to Guevara & Auat Cheein (2020), lower latency can help with instant decision-making and faster data transfer, both of which can lead to improved performance in fields like education and healthcare.

2.2 Cloud Computing and Data Centers

Cloud computing has become an essential part of digital systems because it provides the ability to scale up or down easily, offers flexibility in how resources are used, and helps save money. Gohar and Nencioni (2021) explain that cloud platforms allow companies

to store a lot of data, create applications quickly, and perform advanced data analysis without having to use physical computers.

Studies indicate that cloud computing helps with keeping data safe, recovering from disasters, and making different systems work together smoothly. Bintoro (2024) says that using cloud-based solutions makes services more reliable and helps different groups work together better. In Saudi Arabia, cloud infrastructure is very important for running e-government services, managing healthcare systems, and handling data from IoT devices and AI applications.

2.3 Artificial Intelligence and Digital Infrastructure

Artificial intelligence improves digital systems by allowing automation, predicting trends, and managing systems more smartly. Hu (2025) says that AI uses big sets of data from connected devices, which helps systems predict problems and make them work better. AI is used a lot in managing traffic, saving energy, helping doctors diagnose illnesses, and improving how public services are provided.

Research on Saudi Arabia shows that using AI helps improve how things are done and encourages new ideas. Alhilal et al. In 2020, it was shown that using AI in smart cities helps make them work better by lowering traffic jams, using resources more efficiently, and making services respond faster to people's needs.

2.4 The Internet of Things

Real-time data collection and automatic control are made possible by the Internet of Things, which connects physical devices through sensors and networks. Yusuf and others. It was stated in 2024 that IoT systems aid in energy efficiency, smart transportation, and predictive maintenance, all of which are crucial for building sustainable cities.

In Saudi Arabia, using IoT helps improve how infrastructure is watched, how the environment is managed, and how public safety is maintained. Moubayed et al. In 2022, it's important to note that data created by IoT devices helps respond more quickly to problems in operations and improves the dependability of services. When combined with cloud computing and artificial intelligence, IoT systems make predictions more accurate and help make decisions faster Sustainable urban

2.5 Smart Cities and Public Services

Smart cities use connected digital systems to make things work better, help the environment, and make life better for people. Studies indicate that using 5G networks, artificial intelligence for analysis, internet of things devices for tracking, and cloud computing systems together allows cities to manage themselves instantly. Big projects in Saudi Arabia show how modern digital systems help make traffic better, save energy, and keep people safe.

Digital systems are very important for running government services, providing healthcare, and supporting education. Cloud-based platforms and AI tools help make government work more open and efficient (Guevara & Auat Cheein, 2020). In healthcare, telemedicine and remote monitoring help people get better access to medical services, and in education, digital platforms make it easier to learn online and offer customized teaching (Hu, 2025).

2.6 Challenges and Summary

Even though there are many advantages, the studies point out several important problems. These include expensive costs to set up, risks related to computer security, worries about keeping personal information safe, difficulties in working together with rules and laws across different areas, and a lack of trained experts in this field. These challenges show that we need better policies, training for workers, and good leadership to handle them.

III. RESEARCH METHODOLOGY

3.1 Introduction

This study uses a qualitative approach to look at new trends in digital infrastructure and how they match up with Saudi Vision 2030. Because the focus is on national goals, changes in technology, and planning for the future, it's better to use a qualitative method to deeply understand how digital technologies help the economy and society grow. The approach uses a thorough look at existing research and secondary data to examine how 5G networks, cloud computing, artificial intelligence, and the Internet of Things are helping to move Saudi Arabia forward in its digital transformation efforts.

3.2 Research Design

The study uses a structured qualitative approach with three different methods that work together. To start, I did a thorough review of existing research to look at articles and conference papers that discuss trends, difficulties, and good approaches related to digital infrastructure. Second, we looked at official documents from Saudi Vision 2030, national ICT strategies, and digital transformation policies to check how well the infrastructure projects match the country's goals. Third, a comparative analysis was done to check how Saudi Arabia's digital infrastructure is doing compared to other advanced countries, which helps in understanding how ready, developed, and competitive it is.

3.3 Data Sources

Data was gathered from dependable secondary sources to make sure the research is thorough and meets academic standards. Some of these sources were peer-reviewed journals from sites like IEEE Xplore, ScienceDirect, Springer, and MDPI; official documents from the Saudi government about digital projects and Vision 2030; reports from telecom and technology companies.

3.4 Data Collection Method

A clear and organized way of gathering data was used. The main search terms were digital infrastructure, 5G networks, AI, IoT, cloud computing, smart cities, and Saudi Vision 2030.

The inclusion criteria included:

Articles published between 2018 and 2025 to make sure they are up-to-date and relevant.

Peer-reviewed academic sources, official government documents, and trustworthy industry reports.

Research that looks at Saudi Arabia or other countries with similar economic and technological situations.

Exclusion criteria included:

Non-English publications.

Studies that are not related to digital infrastructure or policy alignment.

Articles that are based on personal opinions without any real data or analysis.

The process started by looking at the titles and summaries, and then checking the full articles. This led to the choice of 65 sources, which included 40 journal

articles, 15 government reports, and 10 industry publications.

3.5 Data Analysis Method

The study used qualitative content analysis along with thematic coding to organize the information. The process followed four stages.

1. Data about digital technologies, how much they are used, which sectors they are applied in, their advantages and difficulties, and how they fit with Vision 2030 was gathered and sorted in a clear way.

2. The data was organized into three main categories: technology trends, applications in different sectors, and themes related to strategic alignment.

3. Saudi efforts were checked against global standards to see how ready they are, how well they can grow, and how consistent they are.

4. The results were put together into a conceptual framework that links digital infrastructure, its use across various sectors, and the goals of Vision 2030. This helps ensure the work is easy to understand, solid, dependable, and ready to be published in academic journals.

3.6 Research Framework

The study uses a conceptual framework that connects different parts of digital infrastructure to their use in various sectors and to the country's overall strategic goals.

Table 1: Research Framework Components

Digital Infrastructure	5G Networks, Cloud Computing, AI, IoT
Sector Applications	Smart Cities, E-Government, Healthcare, Education
Strategic Objectives	Economic Diversification, Innovation, Sustainability, Citizen-Centric Services
Challenges & Enablers	Cybersecurity, Regulations, Workforce Development

3.7 Credibility and Dependability

To make sure the results are reliable and accurate, several steps were taken:

Triangulation: Information was checked by comparing it from different sources like schools, government agencies, and businesses.

Systematic Coding: Using consistent themes for coding helped make the analysis clear and transparent.

3.8 Ethical Considerations

Even though the study used existing data, it still followed all the proper ethical guidelines for research. All sources were correctly mentioned to prevent copying, and only checked and reliable information was used. The steps taken in the research, the rules for including studies, and the ways data was analyzed were all clearly written down to make sure everything was open and could be repeated by others.

3.9 Data Presentation Tools

Tables: These are used to show trends in technology adoption and how different sectors are aligned.

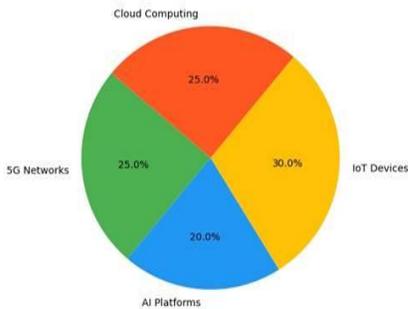
Figures: Simple drawings showing how infrastructure, different sectors, and main goals are connected to each other.

Charts: Pie charts and bar graphs (when used) display how much each technology, like 5G, AI, IoT, and cloud computing, is being used or adopted.

Example: Estimated Digital Infrastructure Adoption in Saudi Arabia

- 5G Networks – 25%
- AI Platforms – 20%
- IoT Devices – 30%
- Cloud Computing – 25%

Estimated Adoption Distribution of Digital Infrastructure Components in Saudi Arabia



IV.RESULTS AND DISCUSSION

4.1 Overview

This part talks about and looks into the results connected to new digital infrastructure trends in Saudi Arabia and how they match up with the goals of Vision 2030. The findings come from a thorough look at academic studies that have been reviewed by other experts, government plans, and reports from industry organizations. The analysis looks at four main technologies—5G networks, artificial intelligence

(AI), Internet of Things (IoT), and cloud computing—and checks how they are used in important areas like smart cities, e-government, healthcare, and education. The results show how much these technologies are being used now and explain how together they help achieve important national goals like making the economy more diverse, encouraging innovation, and providing better public services.

4.2 Adoption of Digital Infrastructure Technologies

The analysis shows that Saudi Arabia has made significant strides in setting up modern digital infrastructure. Adoption levels vary across technologies. IoT devices make up the biggest part, with about 30% of all usage, showing how widely they are used in smart city projects, tracking the environment, and in industrial setups. Both 5G networks and cloud computing each make up about 25%, showing how important they are for fast internet and handling large amounts of data efficiently. AI platforms are used by about 20% of people, and their use is growing steadily. However, the growth is happening more slowly because these platforms are more expensive, there are more rules to follow, and they need special skills to work with them.

4.2.1 5G Networks

The spread of 5G networks in big cities has greatly enhanced how fast we communicate, reduced delays, and increased the amount of data that can be handled. These improvements help with advanced uses like self-driving cars, smart traffic systems, and remote medical care. Big projects like NEOM depend a lot on 5G to help share information quickly, make public safety better, and use energy more efficiently. The results show that keeping up with the growth of 5G networks is important for helping with smart transportation and meeting the larger goals of digital change mentioned in Vision 2030.

4.2.2 Artificial Intelligence Platforms

AI tools are being used more and more in government work, hospitals, and factories. AI-based analytics help make better predictions, handle everyday tasks automatically, and improve how services work. In cities, AI helps predict traffic and manage jams, and in healthcare, it helps doctors diagnose illnesses and plan treatments. Even though the use of AI is still less widespread compared to IoT and 5G, the data shows a

slow but steady increase as new rules are put in place and technology gets better.

4.2.3 Internet of Things (IoT) devices

In Saudi Arabia's digital environment, Internet of Things (IoT) technologies are very important. Smart sensors, connected meters, and monitoring devices are commonly used in city systems, energy grids, and public services. Its wide use helps achieve Vision 2030 goals by making things more sustainable, making operations run better, and allowing better decisions based on data in many different areas.

4.2.4 Cloud Computing

Cloud computing is key to making data management easier, more adaptable, and safer. Government agencies and private companies are more and more using cloud platforms to run their apps, handle big data, and use AI tools. Using the cloud lessens reliance on physical equipment, makes costs more manageable, and makes systems more dependable. Its importance is clearly seen in e-government platforms, smart city management systems, and national healthcare and education services.

4.3 Sector-Specific Applications

4.3.1 Smart Cities

Smart city development is a key part of Saudi Arabia's plan for building better cities, as part of Vision 2030. Projects such as NEOM, Qiddiya, and the Red Sea Project are designed to use combined digital systems. Internet of Things devices are always sending information, and AI helps understand that information in a clever way. 5G allows devices to connect to each other very fast, and cloud systems handle all the data processing from a single main location. These technologies work together to make traffic easier to manage, use less energy, save water, and keep people safe, which helps create cities that are both eco-friendly and work well.

4.3.2 E-Government Services

E-government services have grown a lot because of cloud platforms, AI analytics, and digital monitoring systems. Online licenses, electronic money transfers, and digital government websites make things more open, speed up processes, and help people get more involved. These changes match up well with the goals of Vision 2030, especially when it comes to making

government work better, keeping things fair and transparent, and providing services that focus on what citizens need.

4.3.3 Healthcare

Digital systems have changed how healthcare is provided by using telemedicine, AI help in diagnosis, and tracking patients from a distance. Fast 5G networks allow quick sharing of medical information, and IoT devices help keep track of health continuously. Cloud platforms help keep patient records safe and easy to access. These technologies help people get better access to healthcare, especially in distant areas, which supports the goals of Vision 2030 for public health.

4.3.4 Education

The education field is starting to depend more on digital tools to help with online classes, personalized learning using AI, and sharing content through the cloud. Smart classrooms personalize learning experiences through the use of IoT devices, fast internet, and data analysis. These efforts support the knowledge-driven economy that is part of Vision 2030, improve digital skills, and help build a skilled workforce.

4.4 Challenges and Discussion

Challenges remain despite significant progress. The risk of cybersecurity threats is increasing as systems become more interconnected; however, the high cost of implementing security measures makes it difficult for many to afford them. To ensure that things work together, protect data, and last for a long time, clear rules are required. Besides that, there are still problems because of a lack of skilled workers and making old systems work with new ones. The results show that building digital infrastructure is closely connected to Vision 2030.

V.CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study examined recent developments in digital infrastructure in Saudi Arabia, such as 5G networks, artificial intelligence, Internet of Things technologies, and cloud computing. It also looked at how well these trends align with the goals of Saudi Vision 2030. The results show that the Kingdom has made big strides in

creating a modern digital system that supports the economy in new ways, improves services, and ensures long-term stability. The results show that digital tools are being used more and more in key areas like smart cities, government work, healthcare, and schools. These technologies are all connected and work together as one system, not as separate pieces, which helps share information more effectively, make better decisions, and keep operations running more smoothly. Among the technologies looked at, IoT devices are the most common, especially in smart city projects and urban monitoring systems. 5G networks are really important because they provide quick internet speeds and almost no delay. This feature is useful for things like smart traffic management, providing healthcare remotely, and getting quick AI-powered analysis. Cloud computing helps improve digital systems by offering platforms that can expand as needed, are secure, and can adjust to different requirements for storing and managing data. These platforms are essential for managing government services online, linking digital tools together, and ensuring things run smoothly in various areas. Artificial intelligence platforms, even though they aren't as popular as IoT and 5G at the moment, are becoming more significant as time goes on. People are using AI tools more and more to handle traffic, check for health problems, and make choices in government and companies. Their growing popularity shows that organizations are getting better at using digital tools, more data is now available, and institutions are more prepared to handle these changes. The study shows that using these technologies together helps achieve Vision 2030 by encouraging new ideas, improving the quality of services, and building an economy based on knowledge.

Even though there has been a lot of progress, there are still several challenges to overcome.

High costs to set up, risks from hackers, difficult rules to follow, lack of skilled workers, and issues when old systems link with new ones stop many people from using these solutions a lot.

5.2 Recommendations

Based on what was found in the study, there are several suggestions to improve the development of digital infrastructure and make sure it matches the goals of Vision 2030. To deal with high costs of implementing projects, it's important to focus on strategic

investments that involve both government and private sectors working together. When government agencies, phone companies, cloud service businesses, and tech creators work together, they can bring more resources, lower money risks, speed up the process of getting things done, and encourage new ideas and sharing of knowledge.

Policymakers need to create clear rules, strong security measures, and ongoing watch systems to keep important facilities and personal information safe. Regular checks of the system and training for cybersecurity are needed to lower the chances of digital threats. Training programs, certification efforts, and collaborations with universities and technical schools should concentrate on teaching skills related to 5G, artificial intelligence, the Internet of Things, and cloud computing.

Developing local technical skills helps keep systems running well over time and supports ongoing innovation. Clear rules and shared guidelines should be created to make sure digital platforms can work together easily. Standardization helps make data sharing easier, allows different sectors to work together, and ensures things fit with global standards. Focus should be on important areas like healthcare, education, transportation, and building smart cities.

We should promote more funding for research, innovation centers, and technology start-up spaces to help create digital tools that work well for local needs. It's also important to keep checking on things like how much people are using the system, how well it works, and how happy users are.

REFERENCES

- [1] Alhilal, A., Finley, B., Braud, T., Su, D., & Hui, P. (2020). *Distributed vehicular computing at the dawn of 5G: A survey*. arXiv. <https://arxiv.org/abs/2001.07077>
- [2] Bintoro, K. B. Y. (2024). Overview of vehicle-to-everything communication: Technological advancements, applications, and future prospects in intelligent transportation systems. *Journal of Informatics and Science*. <https://www.trilogi.ac.id/journal/ks/index.php/JI-SA/article/view/2187>
- [3] Convolutional neural networks for 5G-enabled intelligent transportation system: A systematic review. (2020). *Computer Communications*, 153,

- 459–498.
<https://doi.org/10.1016/j.comcom.2020.01.058>
- [4] Fu, Z. (2025). *The application of 5G communication technology in intelligent transportation systems*. *International Core Journal of Engineering*.
[https://doi.org/10.6919/ICJE.202510_11\(10\).0004](https://doi.org/10.6919/ICJE.202510_11(10).0004)
- [5] Gohar, A., & Nencioni, G. (2021). The role of 5G technologies in a smart city: The case for intelligent transportation systems. *Sustainability*, *13*(9), 5188. <https://doi.org/10.3390/su13095188>
- [6] Guevara, L., & Auat Cheein, F. (2020). The role of 5G technologies: Challenges in smart cities and intelligent transportation systems. *Sustainability*, *12*(16), 6469. <https://doi.org/10.3390/su12166469>
- [7] Hu, C. (2025). *Application research of 5G/6G cellular network in intelligent transportation Internet of Things*. *Highlights in Science, Engineering and Technology*.
<https://doi.org/10.54097/hqvyny02>
- [8] Moubayed, A., Shami, A., & Ibrahim, A. (2022). Intelligent transportation systems' orchestration: Lessons learned and potential opportunities. *arXiv*. <https://arxiv.org/abs/2205.14040>
- [9] Pawar, V., Zade, N., Vora, D., Khairnar, V., Oliveira, A. M., Kotecha, K., & Kulkarni, A. (2024). Intelligent transportation system with 5G vehicle-to-everything (V2X): Architectures, vehicular use cases, challenges, and future directions. *IEEE Access*, *12*, 183937–183960.
- [10] Yusuf, S. A., Khan, A., & Souissi, R. (2024). Vehicle-to-everything (V2X) in the autonomous vehicles domain: A technical review. *Transportation Research Interdisciplinary Perspectives*, 100980. <https://doi.org/10.1016/j.trip.2023.100980>
- [11] Saudi Vision 2030. (n.d.). *Vision 2030 Kingdom of Saudi Arabia*. <https://vision2030.gov.sa>
- [12] National Digital Transformation Program (NTP). (n.d.). *Ministry of Communications and IT (MCIT), Saudi Arabia*. <https://www.mcit.gov.sa/en>
- [13] Altowajri, S. M., & Ayari, M. (2025). The synergistic impact of 5G on cloud-to-edge computing and the evolution of digital applications. *Mathematics*, *13*(16), 2634. <https://doi.org/10.3390/math13162634>
- [14] Zreikat, A. I., AlArnaout, Z., Abadleh, A., Elbasi, E., & Mostafa, N. (2025). The integration of the Internet of Things (IoT) applications into 5G networks: A review and analysis. *Computers*, *14*(7), 250. <https://doi.org/10.3390/computers14070250>
- [15] Jain, P., & Huang, Y. (n.d.). Building resilient digital operations integrating cloud, AI, and 5G for enhanced customer engagement. *International Journal of Intelligent Systems and Applications in Engineering*.
- [16] World Bank. (2021). *Smart mobility and transport infrastructure development in the Middle East*. World Bank Reports.
- [17] Taleb, T., Samdanis, K., Mada, B., Flinck, H., Dutta, S., & Sabella, D. (2017). On multi-access edge computing: A survey of the emerging 5G network edge cloud architecture. *IEEE Communications Surveys & Tutorials*, *19*(3), 1657–1681.
- [18] Zang, J., Letaief, K. B., Sun, S., & Cao, Z. (2019). Mobile edge intelligence and computing for the Internet of Vehicles. *Proceedings of the IEEE*, *108*(2), 246–261.
- [19] Khan, L. U., Yaqoob, I., Tran, N. H., Kazmi, S. M. A., Dang, T. N., & Hong, C. S. (2020). Edge computing-enabled smart cities: A comprehensive survey. *IEEE Internet of Things Journal*, *7*(10), 10200–10232.
- [20] Alqahtani, M. M. M., Hashim, H. S. A., Haddadi, E. A., & Al-Shibli, F. S. R. (n.d.). Impact of Internet of Things, cloud computing, artificial intelligence, digital innovation, and IT flexibility on firm performance in Saudi Arabia. *Advances in Social Sciences Research Journal*.
- [21] Smart cities and the IoT: An in-depth analysis of global research trends and future directions. (2024). *Discover Internet of Things*, *4*, Article 19. <https://doi.org/10.1007/s43926-024-00076-3>
- [22] International Telecommunication Union (ITU). (2020). *5G for smart cities and intelligent transport systems*. ITU Publications.
- [23] European Commission. (2020). *5G corridors for connected and automated mobility*. EU Transport Report.
- [24] OECD/World Bank. (2024). *Digital Government Strategies and Competitiveness*. OECD Publishing.

[25] Trade.gov. (n.d.). *Saudi Arabia Digital Economy Overview*. United States Department of Commerce. <https://www.trade.gov/country-commercial-guides/saudi-arabia-digital-economy>