

The kingdom of Saudi Arabia: A Global Leader in Adopting Artificial Intelligence for a Sustainable Future

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Abstract:

The Kingdom of Saudi (KSA), has been a pioneer in leveraging AI technology to address economic, social and environmental challenges besides their quest towards being at forefront on innovation globally. As such, AI is recognized as a strategic enabler of sustainable growth for the nation and Saudi Vision 2030 among other key national initiatives have established, its development as one of

their top priorities. This article examines the role of artificial intelligence (AI) in helping Saudi Arabia become sustainable, its AI policy, key applications across sectors and potential economic, social-ontological effects on economy, society and environment.

It also looks at global collaborations, challenges and the broader implications of AI for how well positioned Saudi Arabia is to compete on a worldwide level.

Keywords: Artificial Intelligence (AI); Kingdom of Saudi Arabia; Leader; Sustainable; Technologies.

Introduction:

With the possibility to revolutionize businesses, economies, and societies all over the globe, the arrival of artificial intelligence signals a major change in technological development. As artificial intelligence systems keep advancing, they present unparalleled chances for solving complicated worldwide issues, optimizing resources, and enhancing decision-making. AI is becoming more and more used to fuel invention and efficiency in several industries including education, energy, healthcare, and transportation.

Acknowledging the potential of artificial intelligence to advance its long-term goals of economic diversification, sustainability, and societal transformation, the Kingdom of Saudi Arabia (KSA) stands among the most aggressive Middle East actors among those nations using AI.

Vision 2030, a bold program created to decrease the Saudi dependency on oil, update its infrastructure, and support a varied, knowledge-based economy, was introduced by Saudi Arabia in 2016.

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AI is considered to be the game changer in the efforts towards economic diversification in Saudi Arabia as it aids in new industries and increases the productivity of existing ones. As economies around the world transition to digital and sustainable modes, the Kingdom is focusing on itself as a competitive country with regard to AI technologies and aims to establish new horizons for science, investment and development. Additionally, Saudi Arabia is using AI as a tool to combat the issues of sustainability worldwide, utilizing AI for the regulation and optimization of energy use, risk reduction and resource management-important objectives for a country that has set high goals for national environmental performance. Saudi Arabia utilizes AI in order to further the sustainability agenda and establish a more cost-effective and eco-friendly future.

Saudi Arabia created an authority named “The Saudi Data & AI Authority (SDAIA)”, it was created to set the national Data & AI agenda for the Kingdom, orchestrate implementation of Data & AI agenda across the government, and oversee agenda execution across its child entities-National Information Center (NIC), the National Data Management Office (NDMO), and the National Center for Artificial Intelligence (NCAI)⁽¹⁾:

National Informatics Center (NIC): Its a national source of data, where all government database lies and solving as primary bulk govt info offers AI enabled platform. Within NIC, Purpose of Estishraf: a source for insight All Estishraf does is use data from the government for decision support. The work is overseen by cross-functional teams to ensure insights are more valuable, strategic imperatives for government leadership and a public good with the ability service improvement.

The National Data Management Office (NDMO) manages national as a digital asset and is responsible for the development of standards, policies and regulations as well as driving compliance.

NCAI will drive AI strategy execution, orchestrate AI research focused on innovations in the field of Data & AI, develop AI solutions and build AI expertise.

At the heart of this vision lies the integration of cutting-edge technologies, with artificial intelligence seen as a main driver for meeting these aims. Emphasizing sustainability and efficiency, the

Saudi administration has devoted significant funding to artificial intelligence research in a number of industries. Among the many vital issues being tackled with artificial intelligence technologies are renewable energy optimization, medical reform, and educational improvement. By seeking to set Saudi Arabia as a regional pioneer in technical development, these programs hope to establish a more sustainable and economically varied future for the kingdom.

The list of critical success factors includes establishing efficient data governance, tackling AI deployment-related ethics challenges, creating a strong AI-skilled workforce, and aligning AI applications with the Kingdom's long-term goals of sustainability. The question we will attempt to answer is as follows: We will address the following question:

How can Saudi Arabia effectively integrate Artificial Intelligence technologies to foster sustainable development while addressing the associated challenges of governance, ethical considerations, and workforce transformation?

This line of inquiry leads to a more comprehensive investigation of many crucial sub-issues. First, how would Saudi Arabia use artificial intelligence to meet its sustainability objectives, especially in the energy sector, and to guarantee environmental protection? Second, what are the ethical issues related to artificial intelligence use, especially in fields like healthcare and data management, and how can these be addressed? Finally, as artificial intelligence powers further economic transformation, what policies must Saudi Arabia put in place to help its labor force prepare for automation-related changes?

This article serves as the foundation in evaluating the worry caused by the swift progress in Artificial Intelligence (AI) has profoundly transformed economies, industries, and societies across the globe.

Saudi Arabia, in line with its bold Vision 2030 reform agenda, is actively incorporating AI as a key instrument for achieving economic diversification, sustainability, and technological progress. This piece delves into AI's role in Saudi Arabia's pursuit of a sustainable tomorrow, emphasizing the nation's strategic programs, investments in AI technology, and its likely effects on various domains such as energy, healthcare, education, and urban planning. Through an analysis of Saudi Arabia's current AI endeavors, this piece underscores the kingdom's aspiration to be a worldwide pioneer in AI implementation and its part in the worldwide shift towards sustainable growth. the use

of AI technologies in academic writing with a little more scrutiny.

This study adopts a qualitative analytical approach based primarily on a literature review and policy analysis of Saudi Arabia's AI initiatives under Vision 2030. Secondary data were gathered from academic publications, official reports, and institutional documents from the Saudi Data and AI Authority (SDAIA), the Ministry of Communications and Information Technology (MCIT), and international organizations. The research critically analyzes the implementation of AI within the framework of sustainable development, identifying key themes, opportunities, and challenges.

To answer the problem raised, the research was divided into three titles, which are:

- Chapter I: Education and Workforce Development*
- Chapter II: AI in Healthcare: Improving Access and Efficiency*
- Chapter III: AI in Mobility and Urban Development*

Chapter I: Education and Workforce Development

The education has witnessed rapid transformations in recent years due to the accelerating technological developments, the most prominent of which is the emergence of Generative Artificial Intelligence (AI), which possesses immense capabilities to bring about a real revolution in improving teaching and learning methods. Since the launch of this technology, it has been used in a wide range of fields, such as education, medicine, and marketing, to accomplish a number of tasks, including generating images, videos, producing creative designs, and creating textual content. One of the most notable and widely known applications of generative artificial intelligence at present is the ChatGPT application, which specializes in generating intelligent conversations automatically.

The education sector is considered one of the most prominent beneficiaries of generative artificial intelligence. It has been used in various contexts such as suggesting ideas, planning lessons, preparing tests, and evaluating students. It has become clear that this technology will increasingly impact the process of teaching and learning. With the continued development of this technology, it is likely that more educational institutions around the world will adopt the use of generative artificial intelligence as a key component in their educational systems.

This makes AI pushing us to reimagine education, as it opens the door for proper endogenous learning, effective administration processes and a knowledge-based economy. AI will shape the working world of the future - from AI in education to the absence of in-person classes & resources⁽²⁾.

1-AI and Education:

The goal of the Saudi Data & Artificial Intelligence Authority is not only to promote a national focus on data that is at odds with other traditional values but also unite this purpose within all levels of government so as icing on the cake-handily; conducting any part whatsoever in accordance with &&according to those basic principles laid down by what we previously called "administrative units" Three affiliated arms, the National Information Center, the National Data Management Office, and the National Center for Artificial Intelligence, will execute the actual decision-making work⁽³⁾.

Artificial Intelligence used in education is the use of artificial intelligence technologies to pop up the process of teaching-learning. This encompasses artificial intelligence-driven tools like adaptive learning systems, automated grading platforms, and virtual tutors⁽⁴⁾.

As a result, AI is revolutionizing education in Saudi Arabia by facilitating personalized learning, improving digital platforms and enhancing educational outcomes. AI-driven platforms are being deployed to customize curricula according to individual student needs and learning styles. Below are some key areas where AI is making a significant impact:

- AI can adapt educational content to individual student needs. AI leverages data on student performance to recommend individualized learning paths, tailoring the exact level of instruction each learner receives. In particular, personalized learning can help students of different ability types to work at their own pace. One area where teachers commonly spend a great deal, millions of hours even, is on administration, like grading and planning.*

- Using AI in this case, will replace some tedious work, enabling the educator to concentrate on the quality of teaching and student involvement. Educationally, technology like AI can be even more appealing, as machines are capable of setting up their own assignments and giving them to students, which they can complete and teachers can use their time on the most important task for kids learning. Thus, it is*

unnecessary to ensure compliance with AI solutions for each practical question. A great gain of time for teachers can be realized from the use of AI systems in grading, as grading of most tasks is done autonomously.

- AI deep learning for instance enabled us to automatically mark the quizzes and the teachers would automatically send the data from assignments to the students. In addition, AI systems can do repetitive lending work of grading papers so that teachers can be more involved in the other aspects instead. A good point is that.

2-Impact on Workforce Development:

While there have been significant improvements in the area of workforce development, challenges remain such as the skill mismatch between education and the labor market, and an over-dependence on the public sector. Academic research highlights continued need for reform⁽⁵⁾.

From supporting personalized learning and enhancing digital platforms to improving educational outcomes, AI is changing the educational landscape in Saudi Arabia. AI-powered platforms are leveraging curriculum based on the needs and learning styles of students⁽⁶⁾.

Boosting the skills of the Saudi workforce at the primary, secondary and higher education levels has been a focus of several reforms. It should be noted that curricula and academic programs need to obtain clear alignment to the needs of the labor market, particularly in technical and vocational education⁽⁷⁾.

There is so much disruption in the workforce as a consequence of the rise of digital technology a number of studies investigate how Saudi Arabia is preparing its workforce for digital transformation. This includes efforts to reskill workers in areas such as artificial intelligence and digital marketing⁽⁸⁾.

3-Bridging Gaps in Access to Education:

A central aim of Saudi Arabia's Vision 2030 is to provide equitable access to high quality education for all Saudi citizens, regardless of their geographical location or socio-economic circumstances. AI has the potential to make a significant contribution towards closing educational deficits, especially in remote or poorly served areas. For example, AI-driven platforms can facilitate long-distance learning,

making high quality content and instruction available to students who live in rural areas the same way it is available to students living in urban centres. The ability of AI to overcome established limitations to access education makes AI a strong enabler of inclusivity and equal access in Saudi Arabia where deep geographical separations and population imbalances frequently result in a lack of educational equity⁽⁹⁾.

In order to cultivate Data & AI skills and talent, selected private schools introduced AI to the curriculum. Ministry of Communications and Information Technology (MCIT) introduced training programs focused on machine learning to be infused into the Ministry of Education (MoE) curricula. Key STEM trainings and courses were introduced to enhance AI and technology skills. In addition, there are several AI boot camps currently held in KSA⁽¹⁰⁾.

Chapter II: AI in Healthcare: Improving Access and Efficiency

All countries are moving away from traditional economic models and towards a knowledge-based learning economy, using modern technologies including data and artificial intelligence that have revolutionized all sectors. Artificial intelligence and Data are at the root of a tectonic shift in how things work today including businesses, industries & our quality of life as humans. The vast amounts of data that are available and the huge computing power mean that some very exciting discoveries continue to be made, especially in their applications for our world.

AI has a significant impact on Saudi Arabia's healthcare system, as it helps to improve care quality, expand access, and improve resource allocation efficiency.

1- AI for Diagnostics and Personalized Medicine:

AI-powered diagnostic tools are becoming more prevalent in Saudi hospitals.

Machine learning and image recognition technology help healthcare providers diagnose diseases like cancer more accurately and quickly than previous approaches. Furthermore, AI is being utilized to build tailored treatment strategies, especially for chronic disorders⁽¹¹⁾.

By studying genetic information and medical records, artificial intelligence allows for more precise therapies for each patient, hence improving patient results and better treatment plans⁽¹²⁾.

2- AI is advancing telemedicine and remote healthcare:

In Saudi Arabia, allowing for virtual consultations and AI-driven health recommendations, particularly in rural and underserved areas.

Rising from artificial intelligence virtual assistants, chatbots, and telemedicine systems, these tools enable patients to remotely access medical treatment. For patients in under served or far off areas, these tools close the distance and therefore increase healthcare access. Babylon Health uses AI-driven technologies, for instance, for virtual consultations, triage, and mobile apps offering medical advice to people, therefore increasing access to healthcare worldwide.

Artificial intelligence together with wearable devices and sensors enables ongoing monitoring of people with chronic conditions such heart disease or diabetes. Real-time analysis of data from these tools helps to identify issues early and give fast responses⁽¹³⁾.

3- Predictive healthcare:

AI models are used in predictive healthcare to track disease outbreaks and health trends. These predictive techniques assist the government in planning for future healthcare demands and ensuring timely actions⁽¹⁴⁾.

AI algorithms can analyze large datasets to predict outbreaks of diseases or identify patients at high risk for certain conditions, such as diabetes, stroke, or sepsis. Early discovery and early treatment can help to keep medical problems from worsening.

Using artificial intelligence aids track and forecast contagious illnesses has also been achieved. Artificial intelligence-driven models aided forecast of the virus spread and guided government policies during the COVID-19 epidemic⁽¹⁵⁾.

Chapter III: AI in Mobility and Urban Development

Saudi Arabia's Vision 2030 outlines a strategic plan for embracing artificial intelligence within the kingdom. It establishes clear objectives aimed at promoting AI's role in achieving economic diversification and sustainable development. This vision centers on broadening the nation's digital economy, improving public services using AI, and nurturing a sustainable environment. To further solidify this vision, the Saudi Artificial Intelligence Strategy was initiated, aiming to establish Saudi Arabia as a global AI leader by 2030.⁽¹⁶⁾

Artificial Intelligence (AI) is reshaping how we think about mobility



and urban development. It's making transportation systems better, helping us plan infrastructure more effectively, and ultimately, creating cities that are more sustainable, efficient, and pleasant to live in. I'm going to dive into the specifics of how AI is doing this, using examples and academic sources to illustrate the points.

1-Smart Cities:

This strategy is woven into the fabric of several ambitious projects, showcasing a dedication to shaping a future where AI propels economic, social, and environmental sustainability. A standout example is Neom, it is planned futuristic city, a centerpiece of Saudi Arabia's Vision 2030 initiative. It's designed to be a smart city powered by artificial intelligence, showcasing sustainability, cutting-edge technology, and groundbreaking innovation.

This city is being built to weave AI, renewable energy, and sustainability into its very foundation. Neom's AI systems are designed to fine-tune energy use, water consumption, transportation, and waste management, aiming to make it a blueprint for the cities of tomorrow⁽¹⁷⁾.

Furthermore, the King Abdulaziz City for Science and Technology (KACST) is a key player in pushing forward AI research and innovation within Saudi Arabia. KACST houses several top-tier centers focused on various AI applications, including machine learning, robotics, and data analytics. By teaming up with leading global tech firms and academic institutions, KACST is driving the creation of AI solutions tailored to tackle specific regional challenges⁽¹⁸⁾.

2-AI-Driven Urban Planning:

AI lets cars drive themselves without people helping, using things like machine learning, computer vision, and sensors. These cars use AI to understand information from cameras, radar, and LiDAR sensors to see the world around them and decide what to do right away⁽¹⁹⁾.

Self-driving cars could help reduce traffic accidents that happen because of mistakes people make, make traffic flow better, and ease congestion by changing how cars are driven (like speeding up or changing lanes).

3-Sustainability and Environmental Impact:

Saudi Arabia is turning to AI with a big focus on sustainability. They see AI as a crucial tool to tackle their energy and environmental issues. In their huge oil and gas sector, AI is being used to make operations

run smoother, cut down on pollution, and get the most out of their resources. AI systems can forecast when equipment needs upkeep, which means fewer breakdowns and less harm to the environment⁽²⁰⁾.

AI is also a key part of Saudi Arabia's push for renewable energy. They're using AI to boost their solar and wind power projects, making them more efficient and figuring out the best times for energy production by looking at weather and location data⁽²¹⁾.

AI's role in energy management even extends to managing the country's water, with smart irrigation systems that use less water while growing more crops.

AI can be a powerful tool for cities aiming to reach sustainability targets, enhancing energy efficiency, lessening environmental footprints, and nurturing more verdant urban habitats.

Chapter III: AI for Sustainable Energy Solutions

The Kingdom is one of the biggest oil producers throughout history in Saudi Arabia. it has nevertheless turned to artificial intelligence to improve energy efficiency and reduce environmental hazards in answer to the international trend toward renewable energy and environmental.

Vision 2030 is a strategic framework, that is intended to reduce reliance on oil exports, and position the nation as a global leader across economy sector, including technology, innovation and sustainability. Particularly highlighting as a priority to transform the economy from being oil-dependent to an information and technology-driven economy and Artificial intelligence is at the core of the roadmap⁽²²⁾.

In its proper implementation, AI leads to a better information society with more productivity, more innovation, and a better environment for entrepreneurship.

Saudia Arabia has made major solar energy investments and artificial intelligence is being used to maximize solar energy output. AI algorithms monitor solar plants, forecast energy production, and maximize energy storage and distribution. By predicting demand and automating energy distribution, this drives the incorporation of renewable energy sources into the national grid⁽²³⁾.

1. AI for Renewable Energy:

By forecasting weather patterns and generation levels, artificial intelligence improves the integration of

renewable energy sources including solar and wind power. By forecasting where and when renewable energy production will peak, artificial intelligence models assist grid operators in more effectively balancing supply and demand.

Since renewable energy sources may be sporadic, artificial intelligence helps to forecast energy storage needs and enhance battery management to maximize energy storage and utilization.

By ensuring that stored renewable energy is used when it is most required, AI systems in battery storage can maximize the timing of energy release to the grid and hence eliminate energy waste⁽²⁴⁾.

2. Energy Efficiency in Oil Production:

Artificial intelligence is also boosting efficiency in the oil industry. Using predictive analytics, AI aids in anticipating possible equipment malfunctions, which diminishes downtime and refines production processes. Furthermore, AI algorithms are employed to pinpoint the most lucrative sites for new oil exploration, leveraging analysis of geological and environmental data⁽²⁵⁾.

Machine learning predictive models can parse through huge amounts of data to forecast energy prices based on supply, demand, and geopolitical factors.

3- Environmental Protection:

Safeguard these resources for those who will come after us. As worries about shifting climates, disappearing forests, pollution, and the dwindling variety of life on Earth mount, the safeguarding of our environment has risen to the forefront of worldwide importance. What follows is an examination of crucial elements in the safeguarding of our environment, accompanied by pertinent scholarly sources.

Saudi Arabia, a nation historically recognized as one of the globe's leading oil producers, is transitioning. Driven by the worldwide shift towards renewable energy and a focus on environmental protection.

Measures to preserve biodiversity in Saudi Arabia have diversified to include all measures to preserve its elements and components in their own natural habitats and to work on developing it in a manner that ensures its continuity and sustainability for future generations.

Saudi Arabia sought assistance in conducting the necessary biological and social studies and surveys to prepare its protected areas national system with the expertise of the International Union for Conservation of Nature. Experts from the Union and the NCWCD in

1991 prepared a document “A national system for conserving wildlife and sustainable rural development in Saudi Arabia,” based on which the declared network of protected areas was established till the time being. The system, which was recently updated according to environmental developments, includes a proposal to preserve 75 areas (including 62 terrestrial areas, 13 coastal and marine areas)⁽²⁶⁾.

the Kingdom has adopted AI technologies. These advancements are aimed at improving energy efficiency and reducing environmental hazards.

AI can also help achieve elasticity goals by helping developers invest in the right solar or wind farms, to counter fluctuations in demand with available power generation⁽²⁷⁾.

Conclusion:

The Kingdom is at the forefront of this fight against climate change, improving access to healthcare, and bettering the quality of life in smart cities, while positioning itself as a leader in AI-enabled sustainability.

Saudi Arabia's investment with AI is crucial and it's beginning to provide transformative changes that will define the next Republic. AI plays a very vital role in bringing together national strategic initiatives needed for the Kingdom to achieve its Vision 2030 goals of economic diversification and sustainability in renewable energy, healthcare, smart cities, and education. As Saudi Arabia entrenches AI as a major instrument in its quest for a diversified, sustainable, and technologically advanced society, this will ensure a prosperous, resilient, and equitable society in that nation. Furthermore, the drive of the Kingdom's own initiatives in this direction may just prove to be the momentum that the world needs for greater socioeconomic sustainability.

The results thus far have, however, been encouraging, leaving Saudi Arabia in a strong position to firm up its conclusions from its leadership in the global AI race. The kingdom, in addressing challenges in workforce development, ethics, and regulation, will then strengthen its position as a model for all other nations wishing to leverage AI for sustainable development.

AI has made a significant social impact in Saudi Arabia, being harnessed to improve the identification of vulnerable populations and provide personalized support in social welfare programs. This targeted

use of AI enables effective resource allocation to support the most vulnerable groups in society, promoting social equity and improving the quality of life within the Kingdom.

AI is thus being put to use in the allocation of critical resources, such as healthcare, education, and housing, to the most vulnerable members of society by simply analyzing socio-economic data.

Saudi Arabia's firm focus on AI technology also encompasses smart cities as evidenced by the NEOM project. NEOM is an area development project that aims to near in the future urban living space that integrates sustainability, economic diversification, and technological advancement. The project seeks to install AI systems in all facets of daily life, including but not limited to, traffic control, resource allocation, waste management, and environmental supervision. These systems are set in place to enhance liveability while protecting the environment, which forms a part of Saudi Arabia's vision for sustainability. NEOM is a gateway project for the rest of the world. It exemplifies the potential for AI technology in creating a green urban setting alongside modern living conveniences.

NEOM can be a shining example for the world how artificial intelligence can be manufactured in a manner that fosters not only economic growth but also enhances the living condition in the cities while ensuring environmental protection.

Artificial intelligence has been crucial to the improvement of the services' quality and accessibility in the medical world. Such innovations are not only improving the quality of health services but also meeting the increasing supply needs of a growing population. The kingdom's investment in AI powered health management systems has also improved the efficiency of hospital operations, which streamlined the reduction of waiting times and costs in providing medical services. Furthermore, the AI technology used for telemedicine and remote monitoring of patients has been particularly beneficial for providing healthcare services to the underserved areas of the country which is important for enhancing the accessibility of quality healthcare services.

AI has altered the teaching and learning processes in Saudi Arabia. The kingdom has adopted AI educational technologies that support individualized students' learning needs and preferences. It has improved not only educational outcomes but has also allowed Saudi Arabia to bridge the skills gaps in some critical areas of the economy

such as technology and AI. With the integration of AI education and research, Saudi Arabia is building a future workforce that can competently work in a more digital and automated world. Further, AI-powered workforce programs are enabling Saudi citizens to be reskilled and upskilled to cope with the demands of automation and technology across sectors.

Through these successes, challenges are still there. A lack of highly skilled professionals trained to develop, implement, and maintain AI systems is one of the biggest hindrances to the adoption of AI in all sectors. This was further informed by Saudi Arabia stepping up investment into education and training programs, to develop local talent in AI, machine learning, data science and the like. By emphasizing education, it ensures that the country's workforce is well-prepared for the challenges of an increasingly AI-driven economy.

Although there are considerable advances made by the government in terms of AI adoption, the ethical and responsible use of these tools is a serious issue at hand. The kingdom has started a dialogue about ethics for AI, emphasizing transparency, accountability, and fairness in developing and deploying AI systems. In the realm of AI, the establishment of a regulatory framework to mitigate the risks associated with privacy, bias and job displacement, as well as the benefits of AI being widely distributed, will be absolutely necessary.

Saudi Arabia's AI endeavors also have targeted global consequences.

According to this study, Saudi Arabia has made significant strides toward integrating AI into important industries that support Vision 2030. However, sustained attention to ethical frameworks, cross-sector cooperation, and workforce training are necessary to achieve full sustainability impact.

Referrals and References:

⁽¹⁾- National Strategy for Data and Artificial Intelligence (NSDAI), Saudi Arabia's Artificial Intelligence Strategy: Moving Toward a Digital Future, 2019, Saudi Data and Artificial Intelligence Authority (SDAIA): <https://ai.sa/index-ar.html> (Consulted on 02/02/2025) at 17h13 (GMT+3).

⁽²⁾- Brynjolfsson, E., & McAfee, A: *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, New York, London, W. W. Norton & Company, 2014, p 84.

- ⁽³⁾- National Strategy for Data and Artificial Intelligence (NSDAI), Saudi Arabia's Artificial Intelligence Strategy: Moving Toward a Digital Future, 2019, Saudi Data and Artificial Intelligence Authority (SDAIA).
- ⁽⁴⁾- Al-Farhan, S., & Al-Harthy, S., AI-driven personalized learning systems in Saudi Arabia's education sector, *Journal of Educational Technology*, 2023, 12(4), p 215-230.
- ⁽⁵⁾- Zahran, H. A., "Challenges in Workforce Development: The Case of Saudi Arabia", *International Journal of Human Resource Development*, 2021, 17(3), p 89-103.
- ⁽⁶⁾- Al-Farhan, S., & Al-Harthy, S. AI-driven personalized learning systems in Saudi Arabia's education sector, *Journal of Educational Technology*, 2023, 12(4), p 215-230.
- ⁽⁷⁾- Al-Saud, S. S., & Qabazard, M., "Workforce Development and the Role of Education in Saudi Arabia's Vision 2030." *Journal of Education and Work*, 2019, 32(4), p 357-378.
- ⁽⁸⁾- Al-Khoury, A. M., "Digital Transformation and Workforce Development in Saudi Arabia", *Journal of Information Technology in Education*, 2020, 19(1), p 22-36.
- ⁽⁹⁾- Al-Busaidi, K., & Jabr, F., Leveraging AI for educational equity in Saudi Arabia, *International Journal of Educational Technology*, 2022, 24(1), p 45-60.
- ⁽¹⁰⁾- National Strategy for Data and Artificial Intelligence (NSDAI), Saudi Arabia's Artificial Intelligence Strategy: Moving Toward a Digital Future, 2019, Saudi Data and Artificial Intelligence Authority (SDAIA).
- ⁽¹¹⁾- Healthcare Technology Solutions in Saudi Arabia: Current Trends and Future Prospects. *Saudi Journal of Health Sciences*, 2022, 9(4), p 234-245.
- ⁽¹²⁾- Rajpurkar, P., et al., "Deep Learning for Healthcare: Review, Opportunities, and Challenges", *IEEE Journal of Biomedical and Health Informatics*, 2017, 22(4), p1588-1600.
- ⁽¹³⁾- Junaid Bajwa, Usman Munir, Aditya Nori and Bryan Williams, Artificial intelligence in healthcare: transforming the practice of medicine." *Future Healthcare Journal*, 2021, 8(2), p 188-94.
- ⁽¹⁴⁾- Smith, A., & Al-Fahad, A., Smart Cities and AI in the Kingdom of Saudi Arabia: Innovations and Challenges, *Journal of Urban Technology and Innovation*, 2021, 15(3), p 98-112.
- ⁽¹⁵⁾- Khera, R., et al., "Predictive Analytics in Healthcare: A Review of Applications and Challenges", *Journal of the American Medical Association*, 2018, 320(13), p 1300-1307.
- ⁽¹⁶⁾- Saudi Data and Artificial Intelligence Authority, Saudi AI Strategy and Vision 2030, Official Report, SDAIA, 2020:
<https://sdaia.gov.sa/ar/default.aspx>(Consulted on 06/02/2025) at 11h13 (GMT+3).
- ⁽¹⁷⁾- Al-Rasheed, M., Neom: The Smart City of the Future. *Smart City Journal*, Saudi Arabia, 2021, 8(4), p 22-33.
- ⁽¹⁸⁾- Shahrani, A., & Abdul-Rahman, S., The Role of KACST in AI Research and Development in Saudi Arabia. *Journal of Technology Innovation*, 2022, 9(2), p 47-59.

- ⁽¹⁹⁾- Gkartzonikas, C., & Gkritza, K., "Autonomous Vehicles and Urban Mobility: Implications for the Future of Transport Systems." *Transportation Research Part A: Policy and Practice*, Elsevier and Universiteiten van Nederland , 2020, vol 137, p 31-47.
- ⁽²⁰⁾- Al-Saleh, N., & Al-Dosary, T., *AI in Saudi Arabia's Oil and Gas Sector: Transforming Efficiency*, *International Journal of Energy & Technology*, Saudi Arabia, 2022, 12(1), p 67-81.
- ⁽²¹⁾- Al-Khater, H., & Khan, M., *AI in Renewable Energy: Saudi Arabia's Path to Sustainability*, *Energy & AI*, Elsevier, Saudi Arabia, 2023, 7(2), p 99-115.
- ⁽²²⁾- *Saudi Vision 2030, Vision 2030: Saudi Arabia's roadmap for the future*, 2016, Government of Saudi Arabia:
<https://www.vision2030.gov.sa/en> (Consulted on 30/01/2025) at 10h55 (GMT+3).
- ⁽²³⁾- *Harnessing AI for a Sustainable Future: AI Applications in Renewable Energy in Saudi Arabia*, *Renewable Energy Journal*, 2023, 16(4), p101-110.
- ⁽²⁴⁾- Zhang, L., et al., "Artificial Intelligence for Energy Systems: A Survey", *Renewable and Sustainable Energy Reviews*, 2020, p119.
- ⁽²⁵⁾- Smith, A., & Al-Fahad, A., *Smart Cities and AI in the Kingdom of Saudi Arabia: Innovations and Challenges*. *Journal of Urban Technology and Innovation*, 2021, 15(3), p 98-112.
- ⁽²⁶⁾- KSA's national source for government services and information, National Portal, *Saudi Vision 2030*:
[https://www.my.gov.sa/wps/portal/snp/aboutksa/environmentalProtection!/ut/p/z0/04_Sj9CPyKssy0xPLMnMz0vMAfljo8zivQIsTAwdDQz9LSw8XQ0CnT0s3JxDfA0M_A30g1Pz9AuyHRUBPXGyKQ!//](https://www.my.gov.sa/wps/portal/snp/aboutksa/environmentalProtection!/ut/p/z0/04_Sj9CPyKssy0xPLMnMz0vMAfljo8zivQIsTAwdDQz9LSw8XQ0CnT0s3JxDfA0M_A30g1Pz9AuyHRUBPXGyKQ!/) (Consulted on 05/02/2025) at 08h30 (GMT+3).
- ⁽²⁷⁾- *The Ethics of AI in Saudi Arabia: Opportunities and Challenges*, 2021, *AI Ethics Journal*, 5(1), p 54-69.