The Reality of The Adoption of Artificial Intelligence and Machines in The Kingdom of Saudi Arabia

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Abstract: *The study aimed to clarify the most important concepts related to artificial intelligence and the most important historical developments that this concept has undergone, as well as to identify the most important types of it with identifying the benefits of its application in institutions and sectors as a whole, and to find out if it has negative aspects for those who work on its application, followed us in our study on the descriptive analytical approach in order to identify and analyze the phenomenon by collecting books, references, information and indicators related to that, and also to reach the desired results. We have found that there is great interest on the part of countries on the subject of artificial intelligence, and one of the most important Arab countries that have sought to harness their efforts to activate artificial intelligence is the kingdom of Saudi Arabia, which has developed a strategy consisting of six different aspects. With the identification of indicators to measure alert levels. We recommend that actual attention should be paid to the topic of artificial intelligence with the provision of all necessary material and financial resources.*

Keywords: Intelligence, artificial intelligence, machine learning, Saudi Arabia.

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Introduction

The topic of artificial intelligence is currently one of the important and interesting topics, because of its importance at all levels, sectors and levels. Organizations are working locally and globally today to find ways to keep up with it and to search for the most important novelties that allow them to abandon traditional methods and less modern technologies with software algorithms and artificial intelligence.

Artificial intelligence is transforming digital infrastructures and searching for modern innovations that support the development of the economy and sectors and allow individuals in its society to live in levels of well-being. today, the world is racing towards providing the most important developments in this field and facilitating aspects of life, economically, socially, and environmentally.

So our research is trying to answer the following main question:

Where countries rely on artificial intelligence and machine learning in general and Saudi Arabia in particular?

First: the theoretical aspect

The topic of artificial intelligence is one of the topical topics in terms of interest and research, so in this theoretical aspect we will present various theories and concepts related to artificial intelligence.

1-the historical development of the concept of artificial intelligence:

The term artificial intelligence is new and modern and can be used historically through the following: (Hadli , cheikh, 2022, p. 847)

- During the Second World War: the famous British computer scientist Alan Turing worked on breaking the Star code used by the German troops to send messages securely among themselves, Alan Turing and his team created a God called bombewhich was used to decipher the sigma messages of the German troops.
- Alt bombe and sigma laid the foundations of machine learning for machines, and from them to artificial intelligence, according to Turing, a machine that can talk to humans without knowing that it is a machine can be said to be an intelligent machine.
- The term artificial intelligence dates back to the middle of the last century, specifically in the 1950s, when Alan Turing did a few tests called The Turing test, the purpose of this test is to measure the ability of machines to show equivalent intelligent behavior.

Artificial intelligence has gone through different periods of time, the most important of which are: (Balaasel,Amrouch, 2022)

- In 1939, Alan Turing created a device called the turning machine, and although this device is primitive, it can apply a complex computer algorithm that was used during World War II to decipher German messages and communications for the benefit of British troops and their allies.

- In 1950, the same scientist created a test called The Turning test. this test consists of a set of questions and three players, one is an ordinary person and the other is a device. the third player is the referee. the task of the two players is to answer the questions that appear on the screen and the referee is tasked with reading the answers without differentiating between the two players. the scientist has suggested that if the referee cannot distinguish between the answer issued by the players, then this device can be considered a smart device.
- In 1951: the American scientist arthlia smuel created a self-learning program for the game cheeckers the scientist Arthur himself was the first to name the term machine learning or machine learning to this branch of artificial intelligence in 1950.
- Artificial intelligence officially began in 1956 at Dartmouth College in Hanover, USA, during a summer school organized by four American researchers, since then the term artificial intelligence, which was probably invented at the beginning to stir up pigeons, after which the most important mathematicians, physicists and computer scientists, most of them working at IBM, gathered and decided to hold a conference in the field of intelligent software, through which the term AI was given to this branch of science.
- From 1978-1960: this period was characterized by stagnation and prosperity in the field of research related to artificial intelligence, including the failure of machine translation and the publication of the first issue of the artificial intelligence Journal in 1970.
- 1980 - 1987: during this period, devices appeared that can greatly help in making decisions called expert devices, and the appearance of these devices led to the return of some material support and interest in artificial intelligence again, but it is worth noting here that many scientists did not consider these devices smart as they are programmed with a huge number of loops IF else to make decisions, which contradicts the basic idea of artificial intelligence, which is decision-making without explicit programming.
- In 1988: the first chess-playing computer named Deep thought appeared, it was designed at CMU University, and later this project developed into another project named Deep Bleu at IBM. Deep Bleu was the first chess game to beat the Russian world champion Garry Kasparov in chess in 1997.
- After 1997, a new leap appeared, calculated for artificial intelligence, with the appearance of the first speech Recognition system, Speech Recognition, called Dragon Naturallys peaking, where this system can perform three tasks: speech recognition, text-to-speech, recognition of spoken commands.
- In the early twentieth century, artificial intelligence achieved greater successes, as artificial intelligence began to be used in data mining, medical diagnostics, smart education, smart cities and a number of other fields throughout the technology industry.
- In 2018, Artificial Intelligence has become a reality, not fiction, and for you it only occupies a place in the world of popular culture. the year 2018 was a major leap for artificial intelligence, as this technology has been largely implemented on

the ground until it has become a major tool that enters into the mainstream of all sectors.

2. The concept of artificial intelligence:

Artificial intelligence can be defined as the intelligence that is shown or simulated by programming codes or machines and this definition raises the question of how to define intelligence philosophically intelligence is a vague concept and can be said to be Intelligence similar to human intelligence for example, Philip Janssen and others define artificial intelligence as the science and engineering of machines with capabilities that are considered intelligent according to human intelligence standards. Many researchers have presented papers on the most important:

Table No. 01: definitions about artificial intelligence

Author	definition
Eduard Vingebaum	A part of computer science that seeks to create and design intelligent formats that give the same intelligence characteristics known in human intelligence and is also defined as the science that aims to create applications capable of performing behaviors described as intelligent in humans.
Martin Wick	The science that is able to build machines that perform tasks that need human intelligence when performing them, such as deduction, learning, and the ability to modify, can also be defined as simulating some aspects of human intelligence through a specific program or application?
Marvin Minsky	The science that is able to build machines that perform tasks that require the ability of human intelligence when performed by a human being is defined by many sources as the study and design of intelligent agents. computer scientist John McCarthy, coined this term in 1956, and defined it as the science of engineering the manufacture of intelligent machines.

Source: (Soltan, 2023, p.319)

From the above, it can be said that artificial intelligence is a science of computer science that aims to innovate and design intelligent computer systems that mimic the style of human intelligence itself, so that those systems can perform tasks instead of humans and simulate their functions and capabilities using their qualitative properties and their logical-computational relationship. (Mohsen, 2023, p. 19)

3.Types of artificial intelligence:

Artificial intelligence is classified into three main types:

- **Weak narrow artificial intelligence:** it is a type of artificial intelligence designed to perform specific tasks accurately and efficiently that sometimes exceeds the capabilities of humans, but it does not have awareness or the ability to think outside the scope of the specific task, and this type of artificial intelligence works based on algorithms and machine learning that allows it to process data and make decisions in limited contexts: such as: presence recognition, machine translation, and smart

assistants such as Siri and Google Assistant. Narrow artificial intelligence is also characterized by its inability to adapt to new tasks without reprogramming or training it, unlike general artificial intelligence, which can think and solve problems in multiple journals.

- **Strong or general artificial intelligence**: it is characterized by the ability to collect and analyze information, and to accumulate experience from the situations it acquires, which qualifies it to make independent and intelligent decisions, such as: instant chat bots, and self-driving cars.

-**Super artificial intelligence:** It is the type of artificial intelligence that has the ability to perform any human mental task in a similar way to the human mind and strong artificial intelligence is considered a qualitative leap compared to narrow artificial intelligence, as it is not limited to tasks only but has the ability to think, learn, adapt and solve problems in a variety of fields without the need for prior dedicated training, and this type of artificial intelligence can understand the world, learn from experiments, and operate complex processes of thinking and cognitive interpretation, making it more flexible and intelligent, and despite being a promising research field, the development of strong artificial intelligence is still in its early stages, and requires significant progress in understanding the human mind And its capabilities as well as complex ethical and technical challenges.

4.Artificial intelligence languages:

Artificial intelligence languages are sometimes called symbolic programming languages and awareness languages that are effective in building artificial intelligence systems, the most important of these languages are:

- Python is one of the most widely used programming languages in the field of artificial intelligence due to its simplicity, and it can be used seamlessly with data structures and other frequently used artificial intelligence algorithms, python has libraries that make many projects possible, whether it is a mobile application, a web application, data science or artificial intelligence, for example, numpy for scientific calculation of machine learning for Advanced Computing and artificial intelligence.

-Prolog language: this language is one of the most sustainable programming languages in the field of artificial intelligence programming, it has the ability to program logic, perhaps this is the reason why it makes it the most widely used programming languages in the field of artificial intelligence programming, and finally the word PROLOG, this language remains side by side with Lips when we talk about development in the field of artificial intelligence, and the features provided by Tree bades structuring and efficient pattern matching and automatic backtracking all these features provide a framework the programming is surprisingly robust and flexible.

- AIML language: this language is the most important thing that distinguishes it is that it draws the structure and planning of artificial intelligence.

- LISP language: LIPS is one of the oldest programming languages and an outstanding language created by Dr. John McCarthy who coined the term artificial intelligence although it is not used much these days, it is a flexible and usable language.

- JAVA language: java is also a great option for Object-Oriented programming focused on providing all the High features because there will be someone to help you with your queries and problems and the original What is in the JAVA language is a technology that enables it to create a single application version that will work on all platforms supported by JAVA.
- C++ language: it is the fastest programming language in the world, it has the ability to update at the hardware level, it enables developers to improve the execution time of their program, and it is very useful for artificial intelligence projects, for example: C++ can be widely used AI, where C++ can be used for statistical AI techniques such as those found in neural networks, algorithms can also be written extensively through it.

5.Benefits and disadvantages of artificial intelligence applications:

Manifested in: (Ali L, Briki, 2024, p.p. 71-72)

A-the benefits achieved from artificial intelligence applications:

artificial intelligence applications are characterized by several characteristics, the most important of which are:

- Reducing errors artificial intelligence and robotics science help us in mining and other fuel exploration operations in addition, these complex machines can be used to explore the ocean floor and thus overcome human limitations, by programming robots they can perform more and more difficult work with larger officials in addition to it does not wear out easily.
- Daily application: computerized methods of automated thinking, learning and cognition have become a common phenomenon in our daily lives, through several applications; digital assistants: the most advanced organizations use avatars, which are replicas or digital assistants capable of interact with users, saving human resources;
- Repetitive work repetitive tasks can be done by nature with the help of artificial intelligence, as machines think faster than humans and can perform multiple tasks and can also be used to perform dangerous tasks.
- Medical applications: in the medical field, we also find a wide and successful application of artificial intelligence, where doctors assess patients and the health risks they are exposed to using artificial intelligence, especially in the detection and monitoring of neurological disorders, where it can simulate and fake the brain, and one of the common applications of artificial intelligence is radio surgery, it is used in the treatment of surgical tumors, which can effectively help in the operation without damage to surrounding tissues;
-There are no breaks.

B-Obstacles of Artificial intelligence applications:

- High cost the creation of artificial intelligence applications requires enormous costs because they are very complex, their repair and maintenance also involves significant costs in addition to high-tech and control of various complex programs.
- There is no initiative, machines do not have emotions and moral values, they carry out what has been programmed and cannot judge what is right or wrong, they cannot

even make decisions if they encounter a situation unknown to them, they do not work properly or they break down in such situations.

- There is no improvement with experience unlike humans, artificial intelligence cannot be improved with experience over time, it stores a lot of data, but the way it is accessed and used is completely different from human intelligence.
- There is no creativity, although the machine can help you in design and creativity, it is no match for the thinking power possessed by the human mind or even the originality of the creative mind.
- Increasing unemployment: the replacement of humans by machines can lead to significant unemployment.

Second: the applied aspect:

Through the theoretical aspect that has been exposed, the previous concepts can be dropped on the Saudi Arabia case study.

1-Overview of the kingdom of Saudi Arabia:

The kingdom of Saudi Arabia is a fully sovereign Islamic Arab state whose religion is Islam, its constitution is the book of Allah Almighty and the Sunnah of the Prophet (peace and blessings of Allah be upon him), its language is Arabic, its capital is the city of Riyadh and the system of government in the kingdom is royal, and the rule is in the Sons of the founding King Abed El Aziz ben Abed El Rahman Al-Faisal Al-Saud and Sons of sons.

The kingdom is located in the extreme southwest of the continent of Asia and is bordered to the West by the Red Sea, to the East by the Arabian Gulf, the United Arab Emirates and Qatar, to the north by Kuwait, Iraq and Jordan, and to the South by Yemen and the Sultanate of Oman. the Kingdom occupies four fifths of the Arabian Peninsula with an estimated area of more than 2,250,000 square kilometers. (Saudi Arabia, no date)

2-levels of artificial intelligence adoption in the kingdom of Saudi Arabia:

The National Artificial Intelligence index classifies the level of maturity of government entities in adopting artificial intelligence into 6 main levels, each level reflects a certain stage of development in the entity's capabilities and practice related to artificial intelligence, and helps to identify a roadmap for continuous improvement as follows:(Sadia, 2025, p. 15)

- Level: 0 absence of capabilities: grade 0 in walking and 4.9%, artificial intelligence has not yet been established within the organization, there are no efforts or capabilities in the field.
- **Level 1 construction phase**: Grade 5% 24,9%, the organization recognizes the importance of artificial intelligence limited initiatives or pilot projects are being built without a clear organizational structure or comprehensive integration aimed at enhancing and starting practical experience.
- **Level 2: activation phase**: grade 2.5% and 49.9%, the regulatory frameworks, strategies and governance verses of artificial intelligence have been activated. initial

application begins at the level of several departments with emerging measurement practices, aimed at capacity-building and implementing controlled experiments.

- Level 3: stage of mastery: 50% and 76.6% artificial intelligence is integrated into processes and corporate decision-making, strategy, infrastructure and skills are integrated, and adoption is based on performance and governance indicators aimed at comprehensive integration at the organizational level.

- Level 4: stage of excellence: grade 80% and 94.4% artificial intelligence contributes to driving strategic transformation and enabling digital services, achieving tangible impact, the scope of initiatives is expanded and evaluated periodically to achieve strategic alignment and maximize value.

- **Level 5: leadership stage:** grade 95% and 100%, the organization leads the national scene in the maturity of artificial intelligence and shows an advanced level of adoption, continuous innovation and achieving measurable impact.

its goal is national leadership and sustainable institutional innovation

Table No. 02: Artificial Intelligence Adoption Measurement Levels

The level of adoption	**0**	**1**	**2**	**3**	**4**	**5**
	Lack of Capacity	**Construction**	**Activation**	**Mastery**	**Excellence**	**Leadership**
Class	0%-4.9%	5%-24.9%	25%-49.9%	50%-79.5%	80%-94.9%	95%-100%
Describe the level of adoption	Artificial intelligence has not yet been established within the organization, and there are no efforts or capabilities in the field.	The organization recognizes the importance of artificial intelligence, and limited training initiatives or projects are being built without a clear organizational structure or comprehen	The organizational frameworks, strategies and governance mechanisms of AI have been activated and the initial application begins at the level of several departments with emerging measurement practices.	Artificial intelligence is integrated into operations, corporate decision-making, strategy integration, infrastructure, and skills, and is adopted based on performance and governance indicators.	Artificial intelligence contributes to driving strategic transformation and enabling digital services, achieving tangible impact and the scope of initiatives is expanded and evaluated	The organization is leading the national scene in artificial intelligence, showing an advanced level of adoption and continuous innovation, achieving measurab

		sive integration.			periodicall y.	le impact.
The goal	There is no	Promote awareness and start practical experience	Capacity building and implementa tion of controlled experiments	Comprehen sive integration at the organizatio nal level -	Achieve strategic alignment and maximize value	- National leadershi p and sustainab le institutio nal innovatio n

Source: (Sadia, 2025, p. 15)

The indicators of measuring levels for the adoption of artificial intelligence aim at the readiness of government agencies to adopt artificial intelligence technologies and the extent of their effectiveness and to promote the development and implementation of effective and sustainable artificial intelligence solutions. it is also a supporting tool to achieve the goals of the kingdom's Vision 2030 by accelerating the adoption of artificial intelligence in priority government sectors.

Conclusion

Through the presentation of the most important theoretical concepts on the subject of artificial intelligence, and the most important historical stations that he passed through, it was shown to us that artificial intelligence is one of the developments that have great importance in our time, the need has become a necessity, and this is for the results achieved by following the strategies of this modern technology. Among the countries that are interested in developing their policies and strategies is the kingdom of Saudi Arabia, which is following national initiatives and establishing digital projects in order to update its methods in accordance with the Sustainability Vision 2030.

Among the most important results of the research are the following:

- We have found that the concept of artificial intelligence has gone through various historical developments and stations until 2018, Artificial Intelligence has become a reality, not fiction, and no longer occupies a place in the world of popular culture only. the year 2018 was a major leap for artificial intelligence, as this technology has grown significantly on the ground until it became a major tool that enters into the core of all sectors;
- We have come to the conclusion that artificial intelligence is a science of Computer Science, which aims to innovate and design intelligent computer systems, which simulate the same human intelligence method so that those systems can perform tasks instead of humans, and simulate its functions and capabilities using its qualitative properties;

- We found that artificial intelligence is divided into three main types, but the researchers agreed that they can be included in two basic types, the strong and the weak;
- We have found that there are many languages supported in artificial intelligence, the most important of which are Python and JAVA, which are the languages that are relied on in software and algorithms;
- We have come to the conclusion that there are many advantages and benefits, the most important of which is that they limit the risks and affect life, but they have obstacles, the most important of which is the lack of acceptance of change, the lack of availability of modern developments and digital structures in countries;
- We have come to the conclusion that there are six dimensions and strategic goals: the first: ambition, the second, competencies, the third: policies and regulations, the fourth/ investment, the fifth/ research and innovation, the sixth: the system.
- We have found that there is a real and great interest on the part of the kingdom of Saudi Arabia in activating artificial intelligence.

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