International Journal of Innovative Research and Scientific Studies, 8(2) 2025, pages: 854-866

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Development of a sustainable society and economy based on knowledge in the United Arab Emirates

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Abstract

This study sheds light on building a knowledge-based society and economy in the United Arab Emirates, where knowledge has become one of the most important factors in determining human development and comprehensive long-term economic growth. This has led the country to move towards achieving sustainable development based on knowledge; therefore, the study will focus on examining and explaining the most important pillars mentioned in the United Nations reports, in the areas of learning and transformation, and the extent to which they have been achieved on the ground, as well as the most prominent challenges faced by the country in the field of planning and implementation. The study noted that the UAE had made great and strenuous efforts to achieve its future vision of being the first country in the world by the year 2071. Just as it has made generous investments in financing education at all levels, communications infrastructure and services, science and technology, and innovation, supported by modern laws and legislation, to achieve the well-being and happiness of its citizens and to transition them to the world of knowledge, innovation, and entrepreneurship. The study concluded that sustainable investments in education, innovation, information and communications technology, and a favorable economic and institutional environment have led to an increase in the use and creation of knowledge in economic production, as recognized by international reports and indicators that placed the UAE among the top ten globally in 24 economic competitiveness indicators during the year 2020. This was achieved by analyzing the UAE's performance within the most prominent modern indicators, in terms of the Global Competitive Readiness Index, global innovation, doing business, education, research, and others, which required a presentation of the most prominent challenges facing decision-makers in this field. The study concluded by developing practical recommendations according to the field reality and the requirements of international organizations.

Keywords: Knowledge society, Knowledge, Knowledge economy, Sustainable society.

DOI: 10.53894/ijirss.v8i2.5340
Funding: This study received no specific financial support.
History: Received: 28 January 2025 / **Revised**: 3 March 2025 / **Accepted:** 6 March 2025 / **Published:** 13 March 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

In the last decades of the twentieth century, knowledge has been a turning point in the global development process, a driver of society, a factor of production of strategic importance in leadership, a key indicator of the level of development, and a measure of each country's readiness for economic and cultural growth. Just as the first industrial revolution used (water and steam) to move machines, the second industrial revolution used (electricity) to achieve large-scale production, and the third industrial revolution focused on the use of (electronics and information technology) (automation, digitization of production); the Fourth Industrial Revolution has begun to combine technologies that eliminate the boundaries between everything physical, digital, and biological, as a number of technologies and scientific engines have emerged that have changed the face of the world, including - in particular - artificial intelligence technology: (robots, the Internet of Things, genetics (human genome), 3D printing, quantum computers, nanotechnology, biotechnology, self-driving cars, big data, virtual currencies, energy storage) [1].

The important assets in the new economy have become: technical knowledge, creativity, intelligence, and information. Intelligence embodied in computer programs and technology across a wide range of products has become more important than capital, materials, or labor. All this is due to the rapid progress in information and communication technology, which Vincenti [2] called "engineering knowledge," referring to the importance of knowledge in organizing life, and as an indicator of the creation of new knowledge and technologies, as well as the number of patents [3]. According to United Nations estimates, knowledge economies contribute no less than 7% of the global GDP and grow at no less than 10% annually. 50% of productivity growth in the European Union is a direct result of the use and production of information technology, marking the era of knowledge workers and ideas, which are the most important capital. While the cost of production was divided by 80% for raw materials and 20% for knowledge, today it is divided by 70% for knowledge and 30% for raw materials [4].

The United States of America was the first to benefit from digital technology and its development, as it became a pioneer in the knowledge-based economy; its commercial and industrial institutions enjoyed the ability to compete in the global market and witnessed the highest unprecedented rate of economic development. Other countries, such as Japan, rushed to participate in the age of digital knowledge and benefit from it in competing for the market. Some Asian countries, such as Malaysia, excelled in the fields of manufacturing digital devices and communication means, while Korea and Singapore were active in the field of digital information technology [5]. As for the countries of the European Union, they hastened to develop the "Electronic Europe" plan in November 1999 to move to the digital age, maintain their ability to compete in the fields of services, industry, health, and the environment, and improve the work environment [6]. Historically, the idea of a knowledge-based economy dates back to the nineties. Its existence has shaped changes in all economic and social fields and reflects the desire of European countries to catch up with America in technological development [7]. The founder of the idea of the "knowledge society" is the American sociologist [8, 9]. The first study of the new economy appeared in the sixties of the last century by the economist [10], who indicated that the new economy is a service economy [10]. The first to use the term knowledge economy was [11]. As for the World Bank, it defined it as: (The economy that achieves effective use of knowledge in order to achieve economic and social development), and there are four basic pillars of the knowledge economy, which are: economic incentive, institutional system, education, innovation, and information and communications technology [12]. The researcher believes that the knowledge economy is the economy in which knowledge is the main driver of economic growth, relying on the availability of information and communication technology, the use of innovation and digitization, and the use of the human mind as capital in the knowledge services industry, with the aim of achieving economic and social development. A successful transition to a knowledge-based economy often depends on the following four basic elements: long-term investment in education, innovative skills, updating information bases, and creating a favorable business environment [13]. It is a combination of four interconnected elements: (acquiring knowledge through scientific research, its subsequent transfer in the education process, its dissemination through information and communication technology, and its use in technological innovations) [14]. According to the World Bank [12] and the Global Innovation Index [15], knowledge economies have been linked to a framework of four pillars based on human capital.

- An educated and skilled workforce is essential for the creation of a strong knowledge-based economy, where workers possess the ability to continuously learn and apply their skills to build knowledge and practice it efficiently.
- A dense and modern information infrastructure is represented by easy access to information and communication technology resources.

- An effective innovation system, with a high level of innovation within companies, industries, and countries, is essential to keep pace with the latest global technologies and human intelligence, in order to benefit from them in the local economy.
- An institutional system that supports incentives for entrepreneurship, utilizes knowledge and provides incentives to allow for better efficiency in resource mobilization and allocation, as well as encourages entrepreneurship [15]. Therefore, the World Bank recommends the transition of the global economy to a knowledge economy and an information society [16].

UNESCO believes that the knowledge society must promote human rights and provide equal and comprehensive access to knowledge by building a just society through four principles: cultural diversity, equality in access to education, comprehensive access to information in the public domain, and freedom of expression [17]. Among the characteristics of the knowledge society is that individuals are raised with various skills, most notably: cognitive skills, information search skills, problem-solving skills, technology use skills, written communication skills, emotional skills, self-knowledge and appreciation skills, motivation to learn, future planning skills, social skills, direct communication skills with others, teamwork skills, and participation in public life skills [18].

It can be said that there is a problem embodied in the issue of the digital divide between societies and individuals who use information and communication technology efficiently and effectively, and those who do not utilize this technology [19]. This digital divide may develop into a quantitative gap, and there is growing concern about the widening of these gaps between developed and developing countries on one hand, and between segments of society on the other; high-income countries, with a population of only about (855) million people, or about (14%) of the world's population, own (90%) of the global market producing and using information and communication technology. In contrast, the remaining middle and low-income countries, whose population is estimated at about (5,500) million people, or about (86%) of the world's population, acquire only (10%) of that market [20]. However, on another level, there are challenges facing these countries, the most prominent of which are: the difficulty of accessing information from the global knowledge system due to their lack of modern technology, and the existence of a digital gap that hinders their progress in becoming part of the global information and knowledge society. This can only be achieved by reducing the digital gap through knowledge management processes centered on transferring and developing knowledge and spreading the culture of innovation and creativity, to bring society to a state in which it can produce knowledge and invent new means of production, which help it secure its needs and achieve greater well-being (Branch, 2004).

It should be recognized that not all Arab countries are at the same level of development; there are countries such as the Gulf countries, which have been able to be strongly active in the field of the knowledge economy and establish a strong base in the field of digital technology, building a knowledge society, and investing in human capital as an important factor in moving towards a knowledge society and economy, most notably: [The United Arab Emirates]. The UAE has focused for more than a decade on launching a national innovation strategy and announced the UAE Vision (2021) and the UAE Centennial Vision (2071) in the hope of being the best country in the world and the most advanced by the centenary of the establishment of [the UAE] in the year (2071). It will have a vision for generations that extends for five decades and forms a clear map for long-term government work, ensuring the continuity of development and the sustainability of happiness for decades, and the transformation towards a knowledge society and economy, while anticipating the future (UAE Vision, 2071). Because the UAE's experience is a pioneer in the field of transformation into a knowledge society and economy compared to Arab countries and many developing countries, and its quest to cross over to the future and seize opportunities through knowledge engineering and building a base and systems of innovation in the field of knowledge and economy, it aims to be consistent with its future strategic vision. The study will adopt a descriptive approach in interpretation and analysis and focus on the central objective of the study, which is summarized in the following question: What are the visions and mechanisms that helped achieve the transition to a knowledge-based society and economy?

1.1. The Study Problem

All Arab countries suffer from many problems and face political, economic, and societal challenges that hinder their development in terms of building a knowledge economy that keeps pace with the technological and cognitive developments witnessed by the world. However, there are a few Gulf and Arab countries that have begun to grow clearly in terms of the transition to a knowledge economy, especially the experience of the United Arab Emirates. Therefore, the research is based on the idea of studying the mechanisms of the knowledge economy in this country as a pioneering model in benefiting from the knowledge revolution. The research problem is determined by the following question: What are the mechanisms of the transition towards a knowledge economy for the benefit of the development and advancement of Emirati society?

1.2. Study Objectives

1. Highlighting the role of knowledge in building Emirati society and its importance in developing the knowledge economy.
2. Knowing the importance of the information society in making human beings basic actors and symbols of intellectual, cognitive, and material creativity.
3. The challenges faced by the Emirates in moving to a knowledge-based society and economy.
4. Knowing the required mechanisms used to transform into a knowledge-based society and economy.

2. Literature Review

Ala [21] dealt with the knowledge economy and its role in achieving economic and social development in Arab countries, the Gulf Cooperation Council countries as a model. The results showed that the dominant characteristic of the economies of the Arab world is still traditional and needs to be developed towards a knowledge economy. This requires a modern educational system, economic incentives, and an advanced vision to build an Arab strategy that meets the needs of Arab societies. Another study by Cader [22] entitled The Development of the Knowledge Economy noted that many countries were able to move to a knowledge and information economy thanks to their interest in developing education and technology, which helped them develop their knowledge economy and made it the top priority of many countries in the world [22].

The study by Heba and Sufyan [4] entitled Knowledge Economy: A Framework Paper showed that the status of knowledge in the Arab world is progressing well in the transition to a knowledge economy, especially in the Gulf countries, and in particular the UAE, which is more qualified than others for this transition. There is also great potential to benefit from the opportunities of Arab economic integration in supporting the transition to knowledge economies in light of the presence of advanced Arab countries in this field, and they have the knowledge capital that can contribute positively to this transformation, such as Egypt, Tunisia, Morocco, Jordan, and Lebanon. The study noted that the communications and information technology sector has become a fundamental pillar of the knowledge economy in these countries, and its contribution to the gross domestic product varies from one Arab country to another [23]. The limited progress achieved by several Arab countries in building and sustaining the knowledge economy is attributed to the challenges related to the economic and institutional system, education and training systems, the innovation system, and the availability of the infrastructure for the knowledge economy (information and communication technology) [4]. Another study by Powell and Snellman [24] that addressed the importance of the knowledge economy in the development of societies found that the economy based on science and knowledge will be the most important during the coming periods of peoples' lives, in addition to the fact that countries that possess knowledge workers and the necessary technical capabilities will be at the forefront of the world's countries in development indicators, which will undoubtedly be reflected in their economies and the well-being of their peoples [24].

The study of Al-Thaqafi and Abdul Raouf [25] entitled (Mechanisms of Transition Towards a Knowledge Economy: An Analytical Study Concerning the Vision of Islamic Sharia) showed that investment in human capital has a positive relationship with achieving economic and social progress and growth. In addition, entering the era of the knowledge economy and the information-based economy requires more investments in developing the efficiency of the human element, which is the main production source in the knowledge economy [26]. Human energies also need to be developed and improved, and this will only be achieved through more spending and investment in human capital, which will be the basic pillar towards launching the era of the knowledge economy and technological and scientific development. Mohamed [27] related to the knowledge-based economy and the importance of human resource development in Malaysia, concluded that developing human elements is the only and most important way to move to a knowledge economy, considering that the human element is the source of renewal, creativity, and development, and this was reflected in Malaysia's development in the field of the knowledge economy [27].

The UAE has identified five factors to enhance the transformation, the most prominent of which are: the presence of vision and political will among the leadership, the availability of the necessary capabilities, and the citizens' response, in addition to appointing the position of Head of the Digital Government [28]. In implementation of the start of the major transformation, the UAE launched in September 2017 the UAE Strategy for the Fourth Industrial Revolution, which included: building the "human of the future" by improving the outcomes of the education sector based on advanced technology and sciences and encouraging national research and applications in universities and specialized centers. The UAE Vision 2021, 2030, and 2071 were also launched. The objectives and strategy of these visions can be summarized in the following points:

- Vision 2010 is based on developing a knowledge-based economy to replace the oil-based economy. The vision is founded on six national axes: a competitive knowledge-based economy based on innovation, a sustainable environment, an integrated infrastructure, a world-class health system, a high-level education system, a safe society, a fair judiciary, and a cohesive society that preserves its identity (Vision website, 2021).
- Abu Dhabi Vision 2030 is a vision to achieve integration between the three aspects of development: economic, social, and environmental, which leads the emirate towards achieving economic development. The overview of the magazine focuses on improving life for all and diversifying its economy into more global and knowledge-based industries, including aviation, space and defense; pharmaceuticals, biotechnology, and life sciences; tourism; health equipment and services; transportation and logistics; education; media; financial services; communication services; energy; and petrochemicals [29].
- The UAE Centennial 2071 is based on four main axes:

a. A government that looks to the future: A government that is led or managed consciously, according to a long-term vision, seeks to achieve social welfare and ensure the existence of new and diverse sources of sustainable government revenues and financial and investment capabilities away from oil.
b. Education for the future: This is achieved by enhancing the level of teaching in advanced science and technology, especially in the fields of space, engineering, innovation, medical, and health sciences. It focuses on enabling schools to become incubator environments in the field of entrepreneurship and innovation and transforming educational institutions in the country into global research centers.

c. A diversified knowledge economy, through the application of several mechanisms, including raising the level of productivity in the national economy, supporting national companies to reach the world, investing in research and development in promising sectors, focusing on innovation, leadership, and advanced industries, and raising and developing a generation of Emirati inventors and scientists.
d. A more cohesive society: By consolidating the values of tolerance, cohesion, humility, respect, and loyalty to the homeland, empowering youth and women, and making happiness and positivity a way of life [30].

This vision was embodied in the UAE obtaining advanced ranks in the Global Knowledge Index for the year 2020, most notably obtaining first place in the Arab world, and 15th globally, as shown in Table 1:

Table 1.
Global Knowledge Index 2020.

	Indicator	Arrangement	The State
1	73.6	1	Switzerland
2	71.1	2	America
3	70.8	3	Finland
4	66.1	15	UAE
5	62.4	39	Qatar
6	50.9	42	Saudi Arabia
7	50.9	43	Bahrain
8	47.5	58	Oman
9	45.8	65	Kuwait
10	45	72	Egypt
11	44.3	76	Lebanon
12	43.9	79	Jordan
13	42.7	82	Tunisia
14	42.6	83	Morocco
15	37.5	103	Algeria
16	28.5	130	Syria

Source: United Nations Development Program, Al Arabiya website, December 13, 2020, link: https://cnn.it/3ckzXjp

The sectors contributing to knowledge also achieved advanced ranks [31] as shown in Table 2:

Table 2.
Sectoral indicators according to the general statistics of 2020.

Sector	Value	Rank
Pre-university education	75.5	10
Technical education and vocational training.	69.6	11
Higher education	55.4	19
Research, development, and innovation.	37.8	29
Information and communication technology.	79.9	14
Economy	73.2	2
Enabling environments	73.9	27

Source: UNDP and Mohammed bin Rashid Al Maktoum Knowledge Foundation, Scientific Knowledge Index 2020, link: https://bit.ly/3rJ9cK3

Historically, the UAE started the transformation project early; in 1995, infrastructure projects for the new digital economy were announced, and the e-government initiative was launched. On May 11, 1999, the initiative to transform the Dubai government into a fully e-government was announced. In May 2007, the Mohammed bin Rashid Al Maktoum Knowledge Foundation was launched to support ideas, innovation, education, entrepreneurship, and research and development. On May 22, 2013, the smart government was launched to provide services to the public wherever they are and around the clock. In 2014, the Mohammed bin Rashid Center for Government Innovation was opened, and the Mohammed bin Rashid Smart Learning Program was launched to create a unique educational environment in schools through the use of 'smart classes,' and the launch of the Minister's e-bag initiative and the Knowledge Center to promote comprehensive electronic transformation in the federal government and government work [32].

The UAE has witnessed growth in specialized knowledge institutions, most notably research institutions, which are the backbone of any knowledge society and the core of its production cycle. It has given strategic attention to seven main areas: renewable energy, transportation, education, health, technology, water resources, and space exploration. Focusing on research in these areas contributes to achieving the UAE Vision 2021, which takes innovation, research, science, and technology as the basis for building a competitive, productive, knowledge-based economy. In recent years, the picture has appeared brighter in the UAE, where spending on scientific research has multiplied several times to exceed 1% of its national income, ranking 24th globally in terms of the percentage, according to data from the United Nations Educational, Scientific and Cultural Organization (UNESCO). It is the only Arab country that has exceeded 1% and reached 1.3% (Al Bayan website, 2020), which is a reasonable percentage compared to Arab countries.

It has exceptionally supported this sector, as the communications sector accounted for (46.3) billion dirhams ($12.6 billion) of the total expected spending in (2020), while the information technology sector accounted for (31.2) billion dirhams ($8.5 billion), a growth of 5.1% over (2019); which helped it obtain the first place in the Arab world and the region in the communications and information technology index, the internet access index, and the internet use index, according to the Global Innovation Index report for the year (2020) [33]. The country maintained the first place - globally - in the mobile broadband internet subscription index, in addition to the second place in mobile phone subscriptions, and advanced to the fourth place in "fiber" internet subscriptions, and the fifth place in the percentage of internet users. The country also advanced (35) places in the fixed broadband subscription index; reaching the twenty-seventh place globally. And from the twenty-fifth place to the second place globally in the communications infrastructure index, which is a competitiveness index Global, issued by the United Nations [34] surpassing many advanced countries in this sector. It also ranked first in the list of countries with the best electronic infrastructure worldwide, and thirty-first in terms of digital quality of life in (2020) [35].

The UAE is among the top ten countries in (34) indicators, and ranked first globally in the following four indicators: mobile internet subscriptions, low inflation, annual change, and debt dynamics. As for the UAE's performance in the other 12 axes: it ranked first in macroeconomic stability, second in ICT adoption, fourth in product market, twelfth in infrastructure, fifteenth in institutions, thirty-second in market size and labor market, thirty-first in financial system and labor dynamics, thirty-third in innovative capacity, thirty-ninth in education, and ninety-second in skills [36].

The country has one of the best communications networks in the world; in addition to the advanced technological infrastructure, it holds a unique global position, especially in terms of the fourth-generation network (G4), which provides superior levels of coverage and quality of performance. It was also distinguished by its announcement in (2011) that Abu Dhabi is the first capital in the world covered by a fiber optic network and the delivery of a fiber optic network to homes worldwide. It is the first to provide (third generation and fourth-generation mobile phone networks) in the region, and it was one of the first countries in the world to start testing (fifth generation networks). It invests in the latest future solutions and technologies such as communication solutions between devices (M2M) and the Internet of Things (IOT).

In the latest statistics for the year (2023), it was found that the number of Internet users reached (9.84) million, as the number of Internet users in the United Arab Emirates increased by (158) thousand (1.6%) between (2020 and 2021). Meanwhile, the Internet penetration rate reached 99.0% in January (2021). As for social media, it also reached 9.84 million users, and the number of its users accounted for 99.0% of the total population in January (2021). Additionally, the number of mobile phone connections reached 17.06 million in January (2021), equivalent to 171.6% of the total population. It is important to note that many people have more than one mobile connection; therefore, the number of mobile phone connections may exceed 100% of the total population, which is (9.94) million people in January (2021) [37]. In the field of education, the UAE has an integrated system that operates under the umbrella of a large number of national strategies, such as the National Innovation Strategy, the National Artificial Intelligence Strategy, the UAE Strategy for the Fourth Industrial Revolution, and the National Strategy for Future Foresight. This comprehensive system begins from early childhood stages and continues through university levels, culminating in graduation and the commencement of the lifelong learning stage to achieve a strong knowledge economy based on innovation, the application of knowledge, and its production [38]

Smart learning programs, new teacher laws, licensing and assessment systems, and curriculum revisions—including teaching mathematics and science in English are part of this strategy [39]. Special attention has been paid to changing K-12 education programs to ensure students are ready to enroll in various universities around the world and are able to compete in the global market. The government has encouraged technology in schools to enhance job opportunities for young people in the (21) century, in line with its strategy to introduce computers and tablets in all schools. The state strongly supports education and learning services for students with special needs. Federal Law No. (29 of 2006) is the first law in the country to protect the rights of persons with special needs [40]. In general, the Ministry of Education's strategy aimed to: ensure equal education - including preschool education - achieve distinguished efficiency for leadership and educational bodies, ensure the quality, efficiency, and governance of educational and institutional performance, ensure safe, supportive, and stimulating educational environments for learning, in line with the needs of the labor market, and enhance scientific research and innovation capabilities according to global competitive standards [41] as shown in Table 3.

Table 3.
Development of education indicators in the UAE.

	Indicator Type	Ratio
1	TIMSS test index	Top 15 Countries
2	Secondary school graduation rate	98%
3	Kindergarten enrollment rate (public and private)	95%
4	PISA test index	Top 15 Countries
5	Percentage of students with high Arabic language skills according to national tests.	90%
6	Percentage of schools with high-quality teachers.	100%
7	Percentage of schools with highly effective school leadership.	100%
8	Percentage of foundation year enrollment	0%
9	Percentage of GDP spending on research and development.	1.5%

Source: UAE Ministry of Education website: Link: https://bit.ly/39mxt2

Modern smart learning systems have also enabled students to work on two tracks: the first is to provide the necessary infrastructure for this and to qualify and develop the skills of young people through the training portal [30]. The second is to empower students through specialized curricula, pioneering activities, and initiatives that simulate the future, qualify young people for the skills of their time, and build an educational system based on consolidating the skills of the 21st century, through the curriculum, interactive activities and scientific exploratory trips, in addition to enhancing innovation in the Emirati school [26]. A special track has also been created for (vocational education) by establishing vocational and technical institutes, and the Abu Dhabi Center for Technical and Vocational Education and Training, in addition to providing (qualitative university education) that competes with the most prestigious international universities [42]. In research and innovation, the vocational education and training research community plays a major role in knowledge development. Still, in today's emerging knowledge society, this means levels of spending on research and development, groups of highly qualified people, and investment in knowledge-related fields. Knowledge production systems now extend beyond the domain of higher education institutions; because they cover a wide range of entities, among others: (such as public laboratories, research centers, think tanks run by politicians, civil society groups, industry, the private sector, and the military complex) [43]. Innovation, however, is not a matter of research, high-tech industry, and entrepreneurship, nor does it depend directly on research, but rather on new management methods, new business models based on information, communications and technologies, investment in modern equipment, and new skills and networks [44].

It can be said that the interest of the United Arab Emirates (UAE) began scientifically in the field of research when the Abu Dhabi government launched the Masdar Institute in 2007 in cooperation with the Massachusetts Institute of Technology (MIT) and New York University, to achieve the economic diversification goals of the United Arab Emirates. This initiative aimed to establish a world-class research and educational institution. The institute also launched its research centers (iCenters), which serve as permanent homes for its research activities and support the development of its research capabilities and priorities in the vertical application fields of energy, water, environment, and sustainable systems at both micro and macro levels. The launch of iInnovation in 2014 has helped direct Masdar Institute's research projects towards commercial applications, which are further enhanced by several programs, workshops, grants, and collaborations. This will strengthen the foundations of research and development across the region, while the intellectual and human capital it produces will stimulate innovative ripples throughout the Middle East [45].

The operations of the Dubai Biotechnology and Research Park (DuBiotech) and the Energy and Environment Park (Enpark) of TECOM Group have been unified under a new name: Dubai Science Park, which facilitates the efforts and activities of life sciences companies by providing modern and advanced laboratories through its institutes: such as the Al Jalila Foundation, which was launched in April 2013; to achieve leadership for Dubai in the field of medical innovation; and the Public Health Research Center at New York University Abu Dhabi, which has developed several centers such as the Diabetes Research Center, the Obesity and Genetic Predisposition Research Center, and the Smoking Cessation Research Center. There is also the Health Research Bank, which was established by the Ministry of Health and Community Protection [46] to contribute to supporting scientific research in various fields of medicine and health, in addition to the Cloning Center, which succeeded in cloning the first camel in the world in April 2009 [47]. To anticipate the future, imagine and design it, analyze potential future scenarios, support decision-makers in understanding emerging technologies to better anticipate and test the future, and support future research to meet challenges, the Dubai Future Foundation was established in April 2016: It is the first research endowment foundation in the Arab region, including accelerating programs, incubators, laboratories, regulatory protection funds, and knowledge platforms, through the most important axes: (the future, anticipation and imagination, disseminating content and knowledge, capacity building, future design, acceleration, and future experience) [48].

The UAE has succeeded in consolidating its position among the most prominent innovation centers in the world, and according to the Global Innovation Index [49] it has maintained its leading position among Arab countries. The country also ranked twenty-second globally in innovation inputs, advancing two places from (2019), and outperforming several countries with leadership in the fields of innovation, such as Iceland, Luxembourg, China, Spain, and Russia. While the country ranked fifty-fifth globally in innovation outputs, advancing three places from its ranking last year) [37] as shown in Table 4, which shows the classification of the most important Arab countries on the Innovation Index for the year 2020.

Table 4.
Shows the UAE's ranking in the 2020 Innovation Index.

Ranking of the most important Arab countries on the Innovation Index 2020		
Value of change in rank	**The State**	**Ranking on the global index**
+2	UAE	34
+5	Tunisia	65
+2	Saudi Arabia	66
-1	Morocco	75
-18	Kuwait	78
	Bahrain	
-1	Jordan	79
-5	UAE	81

Source: Prepared by the researcher and the figures are taken from the GLOBAL INNOVATION INDEX 2020 report.

The UAE's performance has also developed in recent years with regard to the innovation axes, as is clear in Table 5.

Table 5.
Shows the development of the number of axes achieved by the UAE.

The axes in which the state has made progress in the index			
Rank 2019	**Rank2020**	**Amount of progress**	**Pivot**
17	18	1 rank	Human Capital and Research
17	21	4 ranks	Infrastructure
30	34	4 ranks	Market Development
22	30	8 ranks	Business Development
34	50	16	Creative Challenges

Source: Prepared by the researcher and the figures are taken from the GLOBAL INNOVATION INDEX 2020 report.

The UAE outperforms Arab countries in the field of spending on research and development, which amounts to 1.3% of the gross domestic product [50]. It requires significant efforts to increase spending on research and development in the government and academic sectors, as well as in the private sector, to levels higher than those of developed countries. Knowledge has become a vital economic resource, as it is the foundation for economic growth, in addition to being an influential force in other social institutions of modern society. This is challenging to implement efficiently and fairly at the macro level, whether from the perspective of evaluating its impact or measuring its effects [51]. According to the opinion of the UAE Minister of Economy [52], the economy of the UAE is considered an open economy, which is a point of strength, as the country has trade relations with more than 150 countries from six continents. This has spared the country from the repercussions of some crises experienced by certain global economies, such as those of the United States, Europe, China, and Japan. The UAE is also distinguished by diversifying its sources of income and strengthening the knowledge economy, with 30% of the GDP coming from oil exports, while the remaining 70% is distributed across several sectors, including industry, trade, transportation, services, logistics infrastructure, tourism, and financial sectors. There is a plan to reduce the contribution of oil to the GDP to 5% by 2021 and to 7% by 2030. This is reflected in the size of the non-oil economy in the economic policy, as shown in Figure 1.

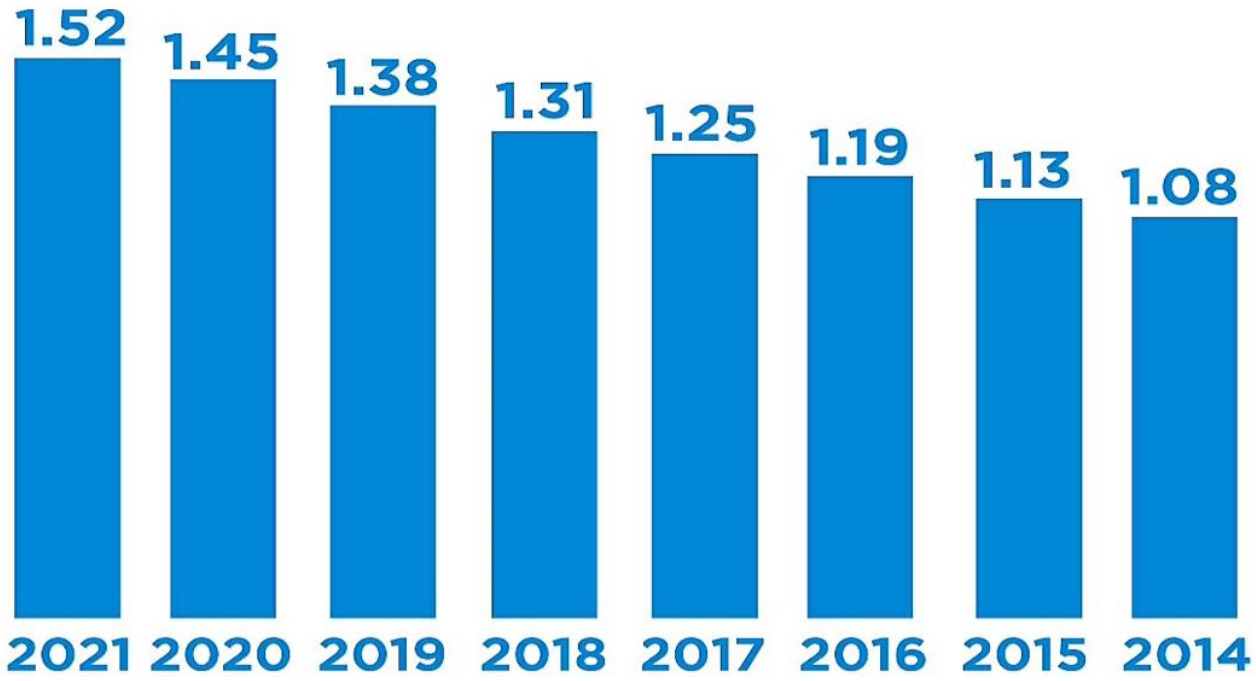

Figure 1.
The size of the non-oil economy
Source: Al Bayan website, link: https://bit.ly/2Ps9U1m.

The UAE has realized early on the importance of building a knowledge-based economy by encouraging innovation, research and development, strengthening the regulatory framework for key sectors, and promoting sectors with high added value. This approach develops the business environment, enhances the country's attractiveness for investments, encourages small and medium enterprises in the private sector, instills a culture of entrepreneurship in universities and schools, and places the UAE among the best countries in terms of per capita gross national income. Additionally, it aims to raise the rate of Emiratisation in the private sector in the coming years, making it the economic, tourist, and commercial capital for more than two billion people. The UAE is moving towards a knowledge-based economy by encouraging innovation, strengthening the regulatory framework for key sectors, and promoting sectors with high added value [53]. The UAE is also one of the most advanced countries in the field of information technology and the adoption of modern technologies in the service of the economy, as it is one of the countries that use smartphones the most in the world. Its strategic plans for the national economy depend mainly on the digital economy and enhancing digital security, which is achieved by adopting

digital economy policies and digital transaction technologies (Blockchain) in financial services and transactions. The country aims to adapt and employ advanced technologies to convert 50% of government transactions at the federal level to the Blockchain platform by 2021. The country is expected to significantly consolidate its position in the digital economy, supported by many factors such as the development of e-commerce, improving the infrastructure of information and communications technology, the spread of electronic services, the use of smartphones, and the expansion of electronic payment systems, as well as the strong government support for the digital transformation process [54].

According to the statistics of the Ministry of Human Resources and Emiratisation [55], the percentage of working citizens out of the total workforce reached 7.62%, including citizens working in the first five skill levels, as well as investors, self-employed, military personnel, and police personnel (Vision 2021 website, 2021). It was also noted that there was a development in the growth rate of the non-oil GDP, as it is one of the most important overall indicators that reflect the state of the national economy and market developments over successive years. The GDP includes the total value of the country's annual production of goods and services; the percentage reached 1% in 2019 [56]. Within the framework of the state's efforts to achieve a knowledge economy based on technology, smart applications, and manufacturing industries; The country has achieved remarkable progress over the past five years in the growth of the knowledge, digital, and industrial sectors, as the "information and communications" sector grew at a cumulative rate of 2.27% in the period (2014-2018), i.e. an average annual rate of 4.5%. The "education" and "professional, scientific and technical activities" sectors also grew at cumulative rates of 2.28% and 5.9% respectively in the same period, i.e. annual growth rates of 6.5% and 9.1% respectively. As for the manufacturing sector, it grew at an annual average of 2.4% in the period (2014-2018), as these sectors combined accounted for approximately 18% of the real GDP in 2018 [57]. Openness to other civilizations through the presence of different nationalities has contributed to cultural, social, and civilizational richness and diversity, in an atmosphere of coexistence and tolerance between citizens and residents; which has encouraged communication and dialogue, cultural exchange, and civilizational interaction between peoples, and diversity of creativity, because it brings different people with scientific qualifications. This explains the issuance of [the Emirates] legislation that encourages scientists and talented people to obtain citizenship and golden residency [58].

3. Study Methodology

The study relies on the comparative analytical approach and reviews the experiences of some countries that have achieved a breakthrough in the field of the knowledge economy to consider the possibility of applying this in other Arab countries. It also relies on the inductive and statistical approach by referring to many sources, statistics, and reports issued by international and regional economic institutions, as well as economic theories and others, in order to extrapolate the reality of this data and use it to accomplish the subject of this paper.

4. Results and Discussion

The above observations indicate the ability and readiness of the United Arab Emirates to meet the requirements of building a knowledge society based on the five pillars adopted by the United Nations Development Program report for the year 2003, and its determination to transform into a knowledge-based society and economy. This requires long-term strategies that focus on developing knowledge skills, as well as an awareness of the requirements of this transformation, understanding its strengths and weaknesses, and then working on them to develop appropriate policies and investments. This will enable policymakers and leaders to follow up on progress, which has been observed in many government plans, literature, and orientations, where transparency in presenting challenges or difficulties and dealing with numbers in a scientific manner is essential to reach the truth.

In general, the UAE has made great strides towards transforming into a knowledge-based society and economy, relying on a society that provides individuals with good education, skills, and experience, enhancing human development and disseminating knowledge. It is trying to enhance localization efforts in all economic and social sectors, upgrade knowledge production capabilities in all economic and social fields, and work to develop the infrastructure of information and communications technology through the Federal Electronic Government project in 2002. The UAE is generalizing information and communications technologies in the banking and business sector, as well as the operations of the ATM network and smart cards. It supports instant sales outlets with payment cards from the account through the instant sales outlet network that covers the country, educates citizens about the importance of knowledge, and increasing digital content in all fields.

The educational system has also been upgraded and developed to achieve the development of knowledge, investing it in the development process, developing education, introducing e-learning to schools and universities, introducing knowledge economy courses in educational and academic institutions, trying to link education and training outcomes to the needs of the labor market, and creating modern and advanced curricula and teaching methods that include the development of cognitive, behavioral, and organizational skills. Its commitment to good governance, innovation, and the business environment, and its attractiveness to foreign investments were also noted. The continued increase in spending on research, development, and innovation to 1.3%, thus ranking twenty-fourth globally - in terms of percentage [59]. The economy has also been developed into a model in which development is based on knowledge, innovation, and diversity, supported by legislation aimed at enhancing market efficiency, protecting intellectual property, and creating partnerships between the public and private sectors, which enhances growth, multiplies opportunities, and makes it one of the best countries in which to do business. There is also progress in building an economic base, the most prominent of which - recently - are: the establishment of the Mohammed bin Rashid Solar Park, the Emirates Nuclear Energy Corporation, the operation of the Barakah Nuclear Energy Plant for peaceful purposes, and the launch of the Hope Probe to explore Mars. Great

achievements and others place the UAE in an advanced global position in the fields of the new economy, based on knowledge and advanced technology, innovation, research, and development; because the (integrated economy) during the next decade is based on three pillars: leading economic sectors, such as space technology and the digital entertainment industry; opening new markets by keeping pace with developments and innovations in global markets; and formulating an advanced legislative environment that serves economic aspirations, and is based on ease of doing business, supporting family businesses, and protecting and stimulating investment [60]. To confirm this information, the (UAE) during its journey to transform into knowledge, in terms of establishing an Emirati knowledge society and a knowledge-based economy, has achieved remarkable results in obtaining advanced indicators from the United Nations, the World Bank, and other organizations, indicating the leadership of the [UAE] in the scientific competitiveness and innovation index, entrepreneurship, the digital competitiveness index, technology, readiness for the future, knowledge, human development, a promising and stimulating environment for investment, confidence in foreign direct investment, smart services, happiness, doing business, government purchases of advanced technology, quality of infrastructure, economic freedom, global prosperity, and other main and sub-indicators [61]. Despite all these achievements, the UAE has set future visions to continue building a knowledge-based society and economy, such as the UAE Vision (2021, 2030, and 2071), which is based on scientifically imagining the present reality, with the necessity of further development, and adopting international reports as a method to reach global leadership and achieve the dream of being the best country in the world.

The UAE faced challenges in transitioning to a knowledge-based economy to cross over to the future, so the decision-makers set the vision (UAE Centennial 2071) for the UAE to be the best country in the world in smart education, entrepreneurship, innovation, the knowledge economy, technology, well-being, and happiness. Naturally, these bold steps face many challenges. There is still a need to develop and restructure the economy in terms of issuing the necessary legislation to regulate the labor market, diversifying the economic base, and accelerating the transition to a world of a knowledge-based economy by focusing on building human capital capable of dealing with the challenges of the new economy, with the importance of developing human resources, which represent the cornerstone for facing economic challenges in the aspects of developing education and scientific research and addressing the imbalance in the population structure that will have many negative effects in terms of politics, economy, society, and security [62]. There is also a problem with the level of quality in terms of student learning outcomes; although the results of the study trends and the two assessment tests: the recent International Mathematics and Science (TIMSS) and the International Student Assessment (PISA) show a tangible improvement, they still represent an obstacle that must be overcome. There is also a problem with the preparation of teachers and professional development, by increasing the level of quality of teachers' skills, so that all professional development programs shift from focusing on supply—not focusing on demand—to ensure that teachers use teaching and learning methodologies and assessment practices that reflect the main objective of developing curricula, students' needs, and the aspirations of the education system to achieve effective education [63].

There is a challenge in the field of industry and innovation to support small and medium enterprises; to maintain their competitiveness within the government's relentless efforts to transform into an innovation-based economy, and to enhance the culture of innovation in small and medium enterprises and institutions operating in the UAE [63] and the importance of moving from knowledge consumption to knowledge management and production, which is the direction in which the country is working through the establishment of the "Supreme Council for the Fourth Industrial Revolution" within the "UAE 2071" plan to build the Emirates of the future, and prepare [the UAE] for future generations. Also, the interest in competing in advanced indicators regarding the classification of local universities globally, within the list of the best (500) universities in the world, and increasing the number of patents registered internationally for [the UAE], and that state institutions are keen to participate and win awards in international forums in sports and global and continental Olympic competitions, and the artistic, cultural and scientific field, especially in terms of nomination for the Nobel Prize and international awards that match it Al Roeya [64]. The report "Youth and Localization of Knowledge in the United Arab Emirates," issued within the general framework of the Arab Knowledge Report, confirms that the (UAE) faces obstacles in transferring and localizing knowledge, as a result of four main interconnected challenges.

Education, youth motivation, human resources, and the economy are, despite the remarkable progress they have made in these areas, still facing challenges. There is also an imbalance in specializations; two-thirds of students specialize in arts and humanities instead of science and mathematics. Regarding the challenge of youth motivation, the report revealed that there is a weakness in the spirit of initiative among youth and graduates. Young people in the Emirates tend to pursue government jobs and administrative work with good financial returns, while they refrain from jobs directly related to the transfer and localization of knowledge. On the subject of human resources, the report asserted that the limited national human power, or national human capital (11.5% of the total population), represents a major challenge in the path of building a knowledge society [65]. However, it should be recognized that the process of successful knowledge transfer and localization is a long-term endeavor, usually involving learning, absorbing, and producing knowledge by members of society. This process takes years due to its complex and intricate nature, its connection to various fields, and its impact on political, financial, and societal crises. Efforts will continue to develop the UAE knowledge society engineering system in light of technological and legal capabilities and developments, with the need for new legislation that keeps pace with new technological advancements and emerging changes in UAE society.

5. Recommendations

Based on the above review of the issue of the transformation of the UAE into a knowledge-based society and economy, and an analysis of what has been achieved at the level of the important pillars related to information and

communications technology, education, research and innovation, and the economy, the study concludes with some recommendations that would support the decision-making process in the UAE:

The necessity of following up on international reports, studying their data and indicators, and trying to adhere to them as much as possible, according to the circumstances, is important. It is essential to measure this progress periodically through government plans, cooperation between all relevant parties, and applying quality standards, such as ISO 9000 and ISO 14000 in government agencies, to improve the quality of work. Ultimately, this is what grants international legitimacy to countries in measuring their progress—according to the charters and laws—that make this data globally recognized.

The importance of starting to develop a strategy to move from knowledge consumption to its management and production, and to deepen its outputs effectively, especially with the existence of an institutional trend working to develop this; by establishing the "Supreme Council for the Fourth Industrial Revolution" within the "UAE 2071" plan to build the Emirates of the future and prepare [the UAE] for future generations, and adopting realistic mechanisms that lead to increasing the dissemination of knowledge bases, and enabling their dissemination and production, through localization and production, and investment in the knowledge field in both sectors (public and private), and entering into partnerships and agreements to purchase knowledge outputs, as part of the drive towards a knowledge-based economy.

Continuously work to increase funding for research, development, and innovation to 1.3% of GDP, in line with international trends; with the aim of reaching 2% of GDP in the coming years, as well as encouraging scientific research, developing its mechanisms, and making it a societal and institutional culture.

Intensifying efforts to improve the quality of education, especially in science and mathematics, throughout the entire education system, increasing their numbers, and enhancing the participation of the private sector in education at all levels; by providing educational opportunities, improving enrollment rates, and reducing dropout rates at all levels of education. Additionally, to enable education to meet the requirements of development and absorb new knowledge, it is essential to develop postgraduate studies and increase enrollment in them, in addition to linking their work and outputs to the knowledge economy, enhancing talent, innovation, and leadership, and developing workforce training programs in the fields of knowledge and modern technology.

The transition to a knowledge-based society and economy can only succeed by enhancing citizens' interest in knowledge and its sources, and by becoming convinced of its importance and direct benefits to their well-being. This requires more work to develop awareness of knowledge and the importance of teamwork and team spirit.

Continuously work to raise the level of Emiratisation in private sector jobs, as the majority of Emirati women prefer to work in the government sector. Additionally, efforts should be made to find innovative job opportunities to address the potential challenges of losing several administrative jobs due to the risks posed by the automated transformation of these jobs. This highlights the importance of providing the country's citizens with the appropriate skills to succeed in the private sector.

There is an urgent and ongoing need to support small and medium enterprises to maintain their competitiveness as part of the government's ongoing efforts to transform into an innovation-based economy and to enhance the culture of innovation in small and medium-sized companies and institutions operating in the United Arab Emirates.

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