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THE ROLE OF DIGITAL TRANSFORMATION IN THE TRANSITION TO THE KNOWLEDGE ECONOMY IN IRAQ, EGYPT AND SOUTH KOREA

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Abstract :

This study aims to identify The Role of Digital transformation in the Transition to the Knowledge Economy in Iraq, Egypt and South Korea, the study relies on the inductive approach, which is based on collecting and analyzing data and information, by forming the theoretical framework for the study and collecting related scientific material from primary and secondary sources. The study also used the standard method to reach the results of the study, by following the ARDEL model to test the relationship between variables, as well as the error correction model was used to find out the type of relationship between variables in the long and short term using the E-Views program. Study finding concluded that Work on the use of modern methods in the field of digital transformation and the use of modern technologies in the field of transition to the knowledge economy in Iraq , also Paying attention to studying the experiences that countries have undertaken in the field of digital transformation and how to achieve a knowledge economy, especially the experiences of Egypt and South Korea, and to benefit from the methods they used to overcome the challenges and difficulties they faced in this field.

Keywords: Digital transformation - Transition - Knowledge Economy – Iraq - Egypt - South Korea

1. Introduction

Economic activity is undergoing profound change, As the economy of the industrial age recedes in favor of the economy of the age of knowledge and the Internet, just as the shift from the agricultural era to the industrial age brought about fundamental changes in the methods of organizing and managing economic activity. The shift to the knowledge economy is capable of changing and achieving new events that affect the economic interests of countries that have to absorb and invest them (Udaltsova, 2020).

Where the economies of the industrialized countries have witnessed structural transformations since the seventies of the twentieth century, which helped them to move from the ranks of industrial economies based on capital and human resources to economies based on the exploitation of knowledge, and since then knowledge and innovations have become one of the most important factors of production and Wealth development, which prompted the governments of these countries to formulate the features of the new economy, and this trend reinforced the outstanding developmental achievements of developing countries that used this technology to establish a prominent position in the world, and these achievements showed that

the countries that were able to invest in this technology enjoy wider opportunities to overcome obstacles structure, and a greater ability to achieve its economic and social objectives. As a result, the conviction became entrenched that social and economic development in the twenty-first century could not be achieved in isolation from the transition to the information society (Azarenko, et al 2018).

Most developing countries, sought to develop ambitious strategies for the development of digital transformation within the framework of the comprehensive development strategy. And foreign affairs in this field, and created a suitable environment to absorb these investments to liberalize markets and develop targeted policies, and remove all obstacles in front of investments. Thus, all these elements together led to the growth of digital transformation, which in turn creates an encouraging work environment and a solid economy, as the world moves towards a knowledge economy in which the rate of cognitive value-added increases significantly, and in which transformation has become knowledgeable goods or commodities. Fundamentally in the growth of the knowledge economy (Attaran, et al 2020).

The research problem lies in the role of digital transformation in the transition towards a knowledge economy in Iraq, where the world is experiencing a real revolution in the field of digital transformation, and no country can no longer aspire to achievement, development, and development without this sector being one of its main pillars, as digital transformation is one of The most important factors that enable economic and social development in Iraq, through new technologies that work to develop the knowledge society, which can accelerate the development process, create job opportunities, and help society shift to a knowledge economy.

Where the economic system witnessed rapid developments, the most prominent of which were the developments in the technological field, especially those related to information processing and dissemination or what is known as information and communication technology, where the problem of researchers and those seeking knowledge was summed up in the difficulty of reaching the required information, either because of its scarcity or because of the difficulty Access to it and its high cost, and with the advent of digital transformation and its rapid spread, the problem has become centered in choosing the information to be obtained amidst a large number of references and data that are permanently available, especially in information networks. With the advent of the twenty-first century, the global economy is moving more and more towards the knowledge economy, which relies mainly on information and communication technology and digital transformation. Here we must stand on what opportunities the knowledge economy will bring? What are the challenges you will face in Iraq?

The world is also witnessing a steady increase in the role of knowledge and information in the economy: knowledge has become the engine of production and economic growth, and the principle of focusing on digital transformation as one of the basic factors in the economy has become a matter of course. New terms began to multiply in this field, such as 'digital transformation', 'knowledge economy', 'education economy', 'third wave' and others. The low status of Iraq's knowledge on the global map and its occupation of a late position and the existence of many challenges that impede the building of the Iraqi knowledge economy in line with global economic development, especially in the field of knowledge and technology transfer and the development of communication systems and increase the number of its users

Hence the problem of the study lies in how to adapt the digital transformation in the transition to the knowledge economy in Iraq and improve Iraq's knowledge position on the global map. And how Iraq can benefit from the experiences of the countries under study and the strategies followed in each of them in order to move to a knowledge-based economy and to know the weaknesses and strengths of each international experience and work to transfer them in line with the available capabilities and serve the goals and challenges facing Iraq at the local, regional and global levels. In order to try to make up for what it missed and to appear on the global map as before, as the reports of the knowledge economy do not include the State of Iraq, despite the inclusion of some of them to approximately 188 countries, and with the help of the comparison countries, we will discuss how Iraq benefits from the experiences of one of the Arab countries, which is Egypt, and one of the countries The leading Asian country, which is South Korea. It should also be noted that the indicators of the knowledge economy are divided into what was before 2017 and beyond, as before that there were only 4 indicators identified by the World Bank, which are (Global Knowledge Index Report, 2012):

- Information and communication technology.
- education.
- innovation.
- Economic incentive and institutional system.

However, after the previous date, a new report on the knowledge economy was issued by the Mohammed bin Rashid Al Maktoum Foundation in the UAE, and a new number of sub-indicators were identified, and they can be summarized in the following figure (1):

Source: Global Knowledge Index Report, 2017

figure (1) : Knowledge economy indicators

The previous figure shows the subcomponents of the Global Knowledge Index in its first edition in 2017, as it is added to the aforementioned components of the knowledge economy in that it separated the unified education index in the knowledge economy index into three indicators, namely, pre-university education, technical education and vocational training, and education The indicators of research, development and innovation, and the index of communication and information technology were maintained, and the economy index, reality analysis, and sub-indicators of the economy of the country under study were added, and the institutional framework was measured by enabling data.

2. Research Methodology:

The study relies on the inductive approach, which is based on collecting and analyzing data and information, by forming the theoretical framework for the study and collecting related scientific material from primary and secondary sources. The study also used the standard method to reach the results of the study, by following the ARDEL model to test the relationship between variables, as well as the error correction model was used to find out the type of relationship between variables in the long and short term using the E-Views program.

2.1.Research problem

From the previous presentation, the study questions can be identified as follows:

- What is the role of digital transformation in the transition to a knowledge economy in Iraq, Egypt and South Korea?
- What are the lessons that Iraq can benefit from the experiences of Egypt and South Korea in benefiting from digital transformation in achieving the knowledge economy?

2.2.Research Objectives

- Determine the role of digital transformation in the transition to a knowledge economy in Iraq, Egypt and South Korea?
- Determine the lessons that Iraq can benefit from the experiences of Egypt and South Korea in benefiting from digital transformation in achieving the knowledge economy?

2.3.Research Importance

The importance of this study lies in its discussion of the various dimensions that affect the development of digital transformation in Iraq and enhance its contribution to the growth of a knowledge-based economy. Iraq, in order to consolidate the status of Iraq and place it on the global knowledge map

2.4.Research Hypotheses

Ho1: The statistically significant positive impact of the level of (digital transformation) on the level of (knowledge economy) in south Korea

Ho2: The statistically significant positive impact of the level of (digital transformation) on the level of (knowledge economy) in Egypt

3. Literature Review

3.1.Concept of digital transformation

According to Pilík, et al (2017) Digital transformation is defined as making changes in how individuals perceive, think, and act, and seek to improve the work environment by

focusing on the use of information and communication technology, in addition to changing organizational assumptions about jobs, so that they include organizational philosophy and values, organizational structures, and organizational arrangements that shape the behavior of individuals. Consistent with the nature of information and communication technology.

Due to Kochetkov, (2020). Digital transformation is also defined as “taking advantage of the information and communication revolution to provide services and products in an innovative way that generates a distinctive experience at all levels.” of the value of its product. As Morkovkin, et al (2020) mention that Digital transformation is also defined as “the process of converting printed materials, or stored on microfilm or microfiche, and materials in analog form, such as audio tapes, video tapes through scanning, and / or re-entry into digital form materials, which is the form in which The computer can deal with it by organizing it into separate units of data called 'bytes', and storing them on internal storage media such as hard disks, and / or external ones such as laser discs.

3.2.Digital transformation goals :

The digital transformation is one of the features of today's civilization, and it is the basic step that must be taken in order to deal with the electronic computer with the elements of entry and exit, and the digital transformation represents the essence of the basic function performed by the input units. From this we conclude that digital transformation aims to (Geyda, et al 2022):

- Take advantage of information and communication technology.
- Improving and facilitating the provision of services and products to citizens.
- Use the innovation method to achieve the best results.

3.3.Requirements for achieving digital transformation (Yankovskaya, et al 2021):

- In the multiplicity of concepts of digital transformation, we find that digital transformation depends on knowledge and the integration of information and communication technology in all fields. Therefore, the requirements of digital transformation require the following:
- Determining the vision precisely, i.e. defining the shape and goal to be transformed and reaching it in the future.
- Continuous review of the digital transformation plan and comparing the achieved with the target.
- The continued vitality of leadership and administrative support for digital transformation efforts, through focusing leaders and all officials on administrative practices related to technology, providing human, financial and material resources, and the necessary legislation.
- Developing existing organizational structures by moving away from complex structures, striving to find flexible organizational structures, and focusing on effective work teams.
- Building a digital transformation strategy in the light of analyzing the market and its needs, analyzing strengths and weaknesses, and surveying opportunities and threats in the external environment.

- Focusing on the technological dimension: by renewing the basic infrastructure of information technology in terms of providing modern devices and various programs.
- Developing human resources: by observing the recruitment and appointment process, and developing the skills and capabilities of all young people through training and self-development programmers.
- Changing the prevailing organizational culture: by spreading the culture of using technology and the Internet, and this requires changing and managing the culture as a competitive advantage.
- Accordingly, the success of the digital transformation process does not depend on the effectiveness of the transformation process only, but rather it requires the capabilities, skills and personal characteristics of leaders and all members of society that reflect the extent of their faith and commitment to the digital transformation process and its stages. Therefore, strategies should be developed in addition to building the capacities of leaders and individuals. With the aim of supporting and endorsing change and in the light of the concepts of integrating information and communication technology in all areas and activities of society.

Also There are many definitions that dealt with the knowledge economy, the most important of which is as Popkova, (2019) mention:

Definition of the World Bank WB: The Bank defined the knowledge economy as the economy in which knowledge is the main engine of economic growth.

Definition of the Organization for Economic Cooperation and Development (OECD): Where I defined the knowledge economy as the economy in which the processes of knowledge production, distribution and use are among the most important engines of economic growth, wealth creation and work in all sectors.

Definition of the United Nations Development Program 2003: Where he indicated that the knowledge economy is the dissemination, production and employment of knowledge sufficiently in all areas of economic, social, civil, political and private life in order to improve the human condition, i.e. the establishment of human development, and it requires building possible human capacities and distributing them optimally.

Definition of the United Nations Economic and Social Commission for Western Asia: Where she defined the knowledge economy as "the economy in which the sectors that use and produce information play the main role in the economy in contrast to the traditional sectors, in which the processes of using raw materials and energy form the main role in generating output, such as agriculture and industry." According to this expression, the economy is considered knowledge when the numbers exceed Employment in information economic sectors Employment in other economic sectors.

The technological revolution has led to maximizing the role of companies working in the field of information technology globally, and after the emergence of the knowledge economy, which has achieved superiority over the traditional economy, in order to achieve the competitive advantage of these establishments. The knowledge economy focuses on information that provides the following (Ragulina, 2019):

- A stream of data that flows easily and quickly between all branches of the economy.

- Converting data into information and then converting information into knowledge for decision makers.
- Converting previous operations by the decision maker into profit.
- A legal and legislative environment and an appropriate general climate that guarantees complete freedom and transparency in the circulation of information and the removal of obstacles.
- A strong communications environment that allows for fast and easy data flow between the various units of the economy.
- Full openness to tools for dealing with information (Internet, electronic business, various information systems).

3.4.International indicators for the countries of South Korea, Egypt and Iraq

3.4.1. Indicators of digital transformation in South Korea:

Here we will discuss the current situation of the system of scientific research and technological development in South Korea to see the improvement of the mechanism of economic indicators, and this situation can be inferred by analyzing the most important indicators of that system contained in the following table during the period under study as follows:

Table No. (1) - Indicators of the scientific research and technological development system in South Korea during the period 2000-2020

2020	2018	2016	2014	2012	2010	2008	2006	2004	2002	2000	*Indicators*
4.81	4.52	3.99	4.3	4	3.5	3.1	2.8	2.5	2.3	2.2	D&R spending as a share of GDP
8714	7980	7086	6899	6361	5380	4868	4175	3301	3034	2345	Number of researchers (per million population(
36	36	27	27	26	29	28	32	33	31.5	35	High-technology exports % of manufactured goods exports
164	193	135	149	130	132	100	93	76	47	54	Advanced

										technology exports (in current US dollars) billion$
180477	162561	163424	164073	148136	131805	127114	125476	105250	76570	72831	Patents A - for residents
46282	47431	45406	46219	40779	38296	43518	40713	34865	29566	29179	B - for non-residents
----	66376	62735	60705	56268	50589	44094	36860	27662	20092	15905	Scientific and technical journal articles

Source / by the researcher based on the World Bank database for multiple years. Available at the link https://data.albankaldawli.org/indicator ON 8 - 1-2023

Note: (---) indicates that the data is not available

From the data of the previous table, it is clear that:

- Looking at the indicator of spending on scientific research and technological development as a percentage of the gross domestic product, we find that this percentage is constantly increasing from 2.2% of the gross domestic product in 2000 until it reached 4.3% in 2014, which reflects the extent of South Korea's interest in spending on research and development. The gross domestic product is constantly increasing, as it was $ 562 billion in 2000, and it continued to increase continuously until it reached $ 1.41 trillion in 2014. However, the proportion of spending on research and development in South Korea increased and reached 4.81 in 2020.
- As for human resources, the data indicates that the number of researchers per million of the population has increased from 2,345 researchers in 2000, to 4,175 researchers in 2006, and then to 6,899 researchers in 2014. Researchers and providing an appropriate environment for them, providing appropriate technology, and appropriate support, and the number of researchers reached 8,714 researchers in 2020.
- As for high-tech exports, the total exports of goods made in South Korea during the study period from 2000 to 2020 amounted to about 17% on average, and this is a very high percentage when compared to Egypt, which is less than 1% during the same period.

- Looking at advanced technology exports (at current prices in US dollars) billion $ during the same period, we find that during the year 2000 it was $ 54 billion, then it increased to $ 93 billion in 2006 and reached $ 118 billion in 2016, and this indicates that the share of high-tech exports In Korea, it is increasing at great rates during the study period, which reflects the technological development of Korea, and the increase in global demand for its products.
- Looking at the system of scientific research and technological development in South Korea, we find that with regard to the total patents granted to residents, it increased from 72,831 patents in 2000 to about 125,476 patents in 2006, and then to 163,424 in 2016.
- As for non-residents, it reached 29,179 patents in 2000, then to 40,713 patents in 2006, reaching 45,406 patents in 2016, and the large difference between patents for residents and non-residents is clear in favor of residents, and this reflects the outputs of Korean education and its policies that are in favor of technological development And provide outputs that meet market requirements, and reached 46,282 patents in 2020.
- Through the previous presentation of the most important indicators throughout the study period, we find that South Korea has paid great attention to the development of its technological infrastructure, and that it has achieved great successes in this field, especially in high-tech exports, and the return from them, providing human resources capable of achieving the hoped-for Korean goals, And it has the ability to compete in the international markets.
- That is, the policies implemented by South Korea, especially those related to human capital and research and development, are policies that have succeeded to a large extent.

3.4.2. Indicators of digital transformation in Egypt:

Here, the current situation of the system of scientific research and technological development in Egypt will be presented to see the improvement of the economic indicators mechanism, and this situation can be inferred by analyzing the most important indicators of that system contained in the following table during the period under study as follows:

Table No. (2) - Indicators of the scientific research and technological development system in Egypt during the period 2000-2020

2020	2018	2016	2014	2012	2010	2008	2006	2004	2002	2000	*Indicators*
0.96	0.72	0.71	0.64	0.51	0.43	0.27	0.26	0.27	----	0.19	D&R spending as a share of GDP
838	687	689	675	517	492	439	631	----	----	----	Number of researchers (per million population(

3	1	1	1	1	1	1	----	----	----	----	High-technology exports % of manufactured goods exports
343	125	56	168	79	105	98.8	----	----	----	----	Advanced technology exports (in current US dollars) billion$
978	997	920	752	683	605	481	488	382	627	534	Patents A - for residents
1229	1258	1258	1384	1528	1625	1649	999	312	788	1081	B - for non-residents
----	13327	11109	9172	8345	6608	4961	4005	3601	3060	2705	Scientific and technical journal articles

Source / by the researcher based on the World Bank database for multiple years. Available at the link https://data.albankaldawli.org/indicator ON 8 - 1-2023

Note: (---) indicates that the data is not available

From the data of the previous table, it is clear that:

- Looking at the indicator of spending on scientific research and technological development as a percentage of GDP, we find that this percentage, although it is very small, is constantly increasing from 0.19 of GDP in 2000 until it reached about 1% in 2020.
- As for human resources, the data indicates that the number of researchers per million of the population has increased from 641 researchers in 2000 to 838 researchers in 2020.
- With regard to high-tech exports, the total exports of manufactured goods in Egypt during the study period from 2000 to 2020 amounted to 1% in most years of the study, but during the year 2020 the percentage increased and reached 3%.
- Looking at the exports of advanced technology (at current prices in US dollars) billion $ during the same period, we find that during the year 2000 it was $ 99 million, then it increased to $ 168 million in 2016 and reached $ 343 million in 2020, and this indicates that the share of high-tech exports In Egypt, it is

constantly increasing, despite the decline in Egypt's share and contribution to the global market.

- Looking at the system of scientific research and technological development in Egypt, we find that with regard to the total patents granted to residents, it increased from 534 patents in 2000 to about 605 patents in 2010, and then to 978 in 2020.
- As for non-residents, it reached 1081 patents in 2000, then 1625 patents in 2010, then decreased to 1229 patents in 2020.
- Through the previous presentation of the most important indicators throughout the study period, we find that Egypt has made many efforts at all levels in order to achieve an improvement in the indicators of technology, digital transformation and the knowledge economy.

3.4.3. Indicators of digital transformation in Iraq:

Here, the current situation of the system of scientific research and technological development in Iraq will be presented to see the improvement of the economic indicators mechanism, and this situation can be inferred by analyzing the most important indicators of that system contained in the following table during the period under study as follows:

Table No. (3) - Indicators of the scientific research and technological development system in Iraq during the period 2000-2020

2020	2018	2016	2014	2012	2010	2008	2006	2004	2002	2000	*Indicators*
0.04	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.03**	**----**	**----**	**----**	**----**	D&R spending as a share of GDP
141	**111**	**65**	**70**	**441**	**432**	**391**	**----**	**----**	**----**	**----**	Number of researchers (per million population(
----	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	High-technology exports % of manufactured goods exports
----	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	Advanced technology exports (in current US dollars) billion
635	**653**	**335**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	Patents

98	**77**	**102**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**
----	**6073**	**1236**	**866**	**826**	**554**	**310**	**248**	**93**	**106**	**92**

A - for residents
B - for non-residents
Scientific and technical journal articles

Source / by the researcher based on the World Bank database for multiple years. Available at the link https://data.albankaldawli.org/indicator ON 8 - 1-2023

Note: (---) indicates that the data is not available

- Looking at the indicator of spending on scientific research and technological development as a percentage of the gross domestic product, we notice a low percentage during the study period compared to the countries under study.
- As for human resources, the data indicates that the number of researchers per million of the population has decreased from 391 researchers in 2008 to 141 researchers in 2020.
- With regard to scientific and technical articles, we find a significant increase in the numbers of these journals from 92 articles in 2000 to 826 articles in 2010. It is also noticeable that there is a significant increase, as the number of articles increased from 1236 in 2016 to 6073 scientific articles in 2018.
- That is, through the previous presentation of the most important indicators over the course of the study period, we find that Iraq should study the situation of the countries under study and try to benefit from the experiences of those countries.

3.4.4. South Korea indictors in the global map of the knowledge economy:

The knowledge economy indicator and its sub-indicators can be clarified through the following table:

Table No. (4) Indicator of the knowledge economy of the State of South Korea during the period from 1995 to 2012.

education index	Creativity index	Economic incentive index and institutional system	Communication and information technology index	knowledge economy index	global ranking	indicators
9.13	**8.22**	**6.93**	**8.34**	**8.18**	**25**	**1995**
9.06	**8.58**	**6.83**	**9.21**	**8.42**	**24**	**2000**
9.09	**8.8**	**5.93**	**8.05**	**7.97**	**29**	**2012**

Source: prepared by the researcher based on KAM Knowledge Assessment Methodology (KAM) 1995, 2000, 2012.

From the data of the previous table, it is clear that:

- The data shown in the previous table indicate that during the period from 1995 until the latest report of the Knowledge Economy Index published in 2012, we find that Korea is among the top 25% of countries in 2012 by ranking 29 globally. It declined from 25th in the world in 1995 to 29th in 2012, through a slight improvement in the period from 1995-2000, when it ranked 24th globally. Balanced with regard to both the indicators of communication and information technology and the creativity index.
- That is, South Korea succeeded in its efforts to maintain a fairly stable and balanced level on the map of the knowledge economy during the study period, as Korea was able to lead the global indicators regarding information technology and remain with the top 25% of the first countries in the knowledge economy index.

3.4.5. Egypt indictors in the global map of the knowledge economy:

Egypt occupies a late position among the group of countries studied by the World Bank, which are 146 countries, as they are located within the group of countries in the Middle East and North Africa, and the value of the knowledge economy index in Egypt is:

Table No. (5) Knowledge economy index for Egypt during the period from 1995 to 2012.

education index	Creativity index	Economic incentive index and institutional system	Communication and information technology index	knowledge economy index	global ranking	indicators
4.64	5.08	4.14	4.87	4.68	87	1995
.....	.....	.....	.....	4.29	88	2000
3.37	4.11	4.5	3.12	3.78	97	2012

Source: Prepared by the researcher based on KAM 1995, 2000, 2012.

- Egypt occupies the 97th place out of 146 countries, and at the global level, Egypt has a low position on the global map compared to the developed economies with high income and the middle-income countries - the upper segment - while it enjoys a better position compared to the low-income countries and the lower segment of the countries with middle income
- The knowledge economy index for Egypt declined on the global economy map from the 87th position in 1995 with an index value of 4.68 to the 88th position in 2000 with a value of 4.29 and then to the 97th position in 2012 with a value of 3.78. With the improvement of the performance of some other economies, which led to the regression of Egypt's position to a position that is later than what was previously

Table No. (6) Internet users (per million people) during the period from 2010 to 2020

2020	2018	2016	2014	2012	2010	The statement numbers are in thousand
17	11	4	1	1	----	Iraq
5939	2066	721	408	268	175	South Korea

42	**33**	**14**	**8**	**5**	**2**	**Egypt**

Source / by the researcher based on the World Bank database for multiple years.
Available on the link ON 9 - 1-2023
https://data.albankaldawli.org/indicator/IT.NET.SECR.P6?locations=EG-IQ&view=chart

3.5.**Global Knowledge Index 2017**:

The Arab Knowledge Index was established to measure knowledge from the perspective of development in the Arab region, taking into account the specificities of the Arab region, its cultural contexts, needs and challenges, and the pivotal role of Arab youth as one of the most important elements for building knowledge societies.

The Arab Knowledge Index focuses on a number of vital sectors such as pre-university education, technical education and vocational training, higher education, information and communication technology, the economy, and research, development and innovation, containing more than 300 indicators in various of these sectors. The Arab Knowledge Index is distinguished in that it It takes into account, for the first time, new sectors such as technical education and vocational training, as well as the interaction between research and development on the one hand and innovation on the other, as well as the interaction between different sectors.

In 2017, the Arab Knowledge Index was developed to include 131 countries from all over the world under a new title "Global Knowledge Index", thus becoming an index of knowledge at the global level, so that the Arab Knowledge Index was published in 2015 and 2016. And in 2017, it was launched The Global Knowledge Index, for the same previous indicators in addition to the enabling environment index, Switzerland came in first place, followed by Singapore and Finland in the ranking of countries in the report, while Yemen came in 131st and last place in the report, while the United Arab Emirates achieved first place at the Arab level and 25th At the global level, followed by the State of Qatar in second place in the Arab world and 41st globally

Table No. (7) The ranking of Korea and Egypt in the new global knowledge index

2021	**2020**	**2019**	**2018**	**2017**	
18	**19**	**19**	**25**	**19**	**South Korea**
88	**72**	**82**	**99**	**95**	**Egypt**

Table No. (7) The ranking of Korea and Egypt in the new global knowledge index
https://www.knowledge4all.com/ar/dashboard

It is clear from the previous table the ranking of Korea and Egypt in the new global knowledge index during the period from 2017 to 2021, as well as the clear relative stability of Korea's ranking during the same period, which demonstrates the success of Korea's policies in preserving its sub-indices and its knowledge index, as evidenced Egypt's ranking in the index improved during the same period. During 2017, Egypt's ranking was 95 globally, and it improved to 82 during 2019. There is also a noticeable improvement in the following year, as Egypt achieved a rank of 72 globally, which

highlights Egypt's role during that period in advancing the knowledge index and sub-indicators. He made efforts on a number of levels to achieve this improvement, and during the year 2021 Egypt achieved the 88th ranking and Korea 18th, and since there is no ranking for Iraq in knowledge reports, the Korean and Egyptian cases must be studied and benefit from those experiences.

3.6. The result of countries' experiences in digital transformation and the knowledge economy

3.6.1. Development efforts and transformation towards a knowledge economy in South Korea: South Korea announced its national strategies for the knowledge economy in 2000, which included five main axes, including (information infrastructure, human resources, knowledge industries, science and technology, and societal convergence in the field of information).The most important objectives of the strategy were as follows:

- Strengthening the fundamentals of the market economy by carrying out structural reforms in the financial sector, the government sector, the business sector, and the labor market, in order to reduce government interference in economic activity.
- Opening up to the outside world by following liberalization policies to attract foreign direct investment and providing a social and cultural environment that allows openness and mobilization of internal and external resources.
- Intensifying human investment to develop creative and innovative energies by focusing on learning, training, science and technology, research and development, communications and information systems.
- Narrowing societal differences in levels of knowledge, technology and income.
- Stimulating research and development systems, knowledge creation processes and patents, i.e. adopting a system of economic incentives.
- Achieving effective participation between the government, the private sector, civil society institutions, and the people.

This should be implemented through a number of axes as follows:

3.6.1.1. the axis of communication and information technology: -

Where the Korean government focused on developing its infrastructure and information by focusing on local technologies instead of abroad, while stimulating the private sector and relying on these national technologies, and Korean efforts centered on implementing, developing and benefiting from this axis, it implemented the Korea 1999 project.

The Cyber Korea project in 1999 included the following objectives:

- Defining six strategic areas to develop the competitive technical capabilities of Korean companies at the international level (next-generation Internet, telephone communications, optical fibers, digital broadcasting, wireless communications, computer operating programs)
- Creating one million jobs and spending 118 trillion yuan to develop the communications and information technology sector.
- Providing more than 5,000 enterprises with risk capital, with doubling the proportion of the Korean component in information technology equipment.

- Increasing the number of Internet users to 10 million by the year 2000.

3.6.1.2. **the institutional framework and the business environment**:

In the aftermath of the Asian financial crisis in 1997, the Korean government adopted a set of reform programs aimed at improving the efficiency of the financial system, providing a stable economic climate for the business sector, enhancing market competitiveness, reducing quantitative and non-quantitative restrictions for customs in order to liberalize trade, as well as restructuring government institutions and adhering to the rules of good governance. In terms of transparency and disclosure of information, this trend has helped support the knowledge-based economy. A ministry called the Ministry of Knowledge Economy was established in 2008 in order to support the innovative and competitive capabilities of small and medium enterprises by creating a supportive work environment to benefit from knowledge and information and communication technology.

3.6.1.3. human capital development, research and development:

A / Human capital development

So that one of the priorities of the policies set in South Korea was the gradual shift from investing in in-kind capital to investing in human capital, and this investment orientation for the development of human resources resulted in the following advantages:

- Complete eradication of illiteracy as of the late nineties, after the illiteracy rate was close to 10% in 1970.
- Maintaining full absorption in primary education (100%) as of 1975.
- The increase in enrollment rates in general secondary education from less than 40% in 1970 to more than 90% in 2004.
- The increase in the enrollment rate of general and technical secondary school graduates in universities and higher institutes (89% and 62%, respectively, in 2004), compared to 40% and 10%, respectively, in 1970.
- Low dropout rate from intermediate education (0.8%), secondary education (2.1%) and higher education (2.5%).
- An increase in the enrollment rate in university education to about 62% in 2004.
- The percentage of the population with higher education has increased to 39% of the total population.

One of the most important features that distinguishes the Korean experience in caring for education is that it is considered a model in how to adapt education to serve economic goals. It is also considered as a strategy for other countries to follow in the same footsteps of the Korean experience in education. The features of this strategy are as follows:

- Compatibility of the system with the requirements of the stages of economic development.
- Continuing national plans for human resource development, and what this requires in terms of reviewing objectives, strategies, policies and all elements of the educational system, including institutional frameworks, and continuous follow-up of performance indicators and output evaluation.

- The growing role of private investment in the field of education, especially secondary and university education, which enabled the government to provide more funds for basic education.

B/ Expenditure on research and development:

Among the most important Korean efforts in the field of research and development are the following:

- The active role of the government sector in supporting research and development activity by establishing scientific and research infrastructure bases in line with the requirements of each development stage.
- Stimulating the private sector to invest in research and development as protection from the risks of foreign competition in light of the government's adoption of the export-orientation strategy and in light of the industrial organization's dependence on giant companies that are able, by virtue of their size and financial resources, to finance spending on research and development programs, and this is in addition to granting tax benefits and financial incentives. To activate scientific research for the private sector, and to provide technical support for small and medium-sized projects.
- Adapting the transfer of knowledge, starting with importing foreign technology, absorbing and adapting it at a later stage, and then starting to replace local technologies as an alternative in light of the growing national innovative capabilities and the availability of relatively skilled technical labor produced by the educational system.
- The influx of foreign direct investment, licenses for foreign companies, and imports of capital goods, which achieved great successes in transferring technology from abroad to the inside, especially in the nineties.
- Focusing research and development efforts in industries with a competitive advantage, which are industries related to communications and information systems, such as manufacturing communication devices, semiconductors, computers, and electronic and electrical products.
- The Korean policies also implemented many facilities in order to achieve further development with regard to the research and development axis.
- Increasing public support directed to basic research, supporting research centers in universities, providing incentives, designing a system that provides qualified graduates for industry, removing regulatory obstacles that limit the movement of researchers from public institutions to private companies, stimulating innovations in the field of small and medium enterprises, shifting from an innovative support system to sectoral level to enhance innovative efforts at the level of industrial clusters,
- This is in addition to coordination between the policies of ministries and agencies concerned with innovation (educational policies, industrial policies, and science and technology policies).

3.6.2. Development efforts and transformation towards a knowledge economy in Egypt.

We review the most important developments that Egypt witnessed regarding the communications and information technology sector, since the start of providing automated services until the great development of the sector, as follows:

- Automated service began in Egypt in 1929 with the first electro-mechanical, rotary exchange in Ramses. After that, electro-mechanical exchanges, the cross-pole system and electronic exchanges were installed, and then digital electronic exchanges were used, and this type was used for the first time in 1987 with a capacity of 40,000 lines in the exchange. In downtown Cairo, a contract was signed to establish a new building for digital exchanges in 6th of October City, with the participation of Telecom Egypt, the Egyptian Company for Telephone Equipment Industry, and the German company Siemens to produce automatic exchanges with a capacity of 250,000 lines annually.
- The development of the telephone network, as the number of telephone lines reached 510 thousand telephone lines in 1981, then the number increased to 6.4 million telephone lines in 1999, and in 2002 the number reached 9.4 million telephone lines. As for subscribers, the number jumped from 418 thousand in 1981 to 4.9 million in 1999, then The number reached 7.2 million subscribers in July 2002.
- As for the cities connected to the automated pager, the number reached 7 cities in 1981, then the number jumped to 278 in July 2002.
- The integrated digital network service was introduced, through which a large number of regular and digital telephones, faxes, computers and the Internet are provided on the same telephone line using the end of the subscriber's terminal. The number of subscribers in 1999 reached 50 subscribers, and the number reached 8,249 subscribers in July 2002.
- For subscribers of the National Information Network, the number of subscribers reached 1910 subscribers in 1999, and the number reached 2,564 in July 2002. The network is connected to a number of other international networks at the international level in America, France, Spain, England and Syria.
- Many advanced international communication centers have been established and provide booths for the public service of the currency system as well as the magnetic card for local and international communications. The number of TE booths reached 250 in 1981, and the number reached 4912 booths in July 2000.
- Microwave networks have been established between Egypt and Jordan with a capacity of 960 circuits, and between Egypt and Libya with a capacity of 1180 circuits, in addition to fiber optic cables between Egypt and Libya.
- Egypt has worked to benefit from the transit communications traffic by subscribing to the international submarine cables such as the Samoy submarine cable and the Falah international marine cable linking Japan and Europe.
- Many space stations have been established, where two stations work with the satellites of the International Space Corporation (Intelsat), another works with the Arab satellite Arabsat, and one station works with the satellites of the Maritime Space Corporation Inmarsat. There are also 4 stations working to provide 11 television channels working with Atelsat, Arabsat and Asiasat, and the Iridium system for communications via

satellite was introduced (and through the "Iridium" system, customers, both companies and individuals, are able to use telecommunication services in remote and remote areas where there is no coverage of fixed and mobile communications networks). The number of subscribers to this system reached 172 in 1999, then this number rose to 204 in July 2000.

- There are many measures that have been taken in the field of data delivery networks, where Egyptney was established in 1989 to transfer data, and this company covers Cairo, Alexandria, Suez and the Delta governorates, and works to provide communication with information networks in Europe, Asia and America, then followed by the establishment of Readeptnet to transmit Data on financial markets, exchange rates, foreign trade statistics and export opportunities. It also has contact with commercial representation offices in Egyptian embassies abroad.
- The G.S.M900 mobile phone started working in cooperation with the French company Alcatel and Telecom Egypt to cover the regions (Greater Cairo, Alexandria, Ismailia, Luxor, Aswan, Sharm El-Sheikh, Hurghada, and the desert roads between Cairo, Alexandria, Cairo and Ismailia).
- In addition to voice services, the mobile phone provides fax services and Internet communications
- In 1999, this system was restructured so that Mobinil companies and bankers, and now Vodafone, work to cover all parts of the Republic.
- The Internet was introduced in Egypt in 1993 through the Egyptian Universities Network in the Supreme Council of Universities with a capacity of 64 kilobits / second, then after that the Information and Decision Support Center headed by the Council of Ministers and many private companies, and the total capacity of the Internet reaches 895 million pulses / second and the number of users 2.3 million users in 2002. The Internet also covers all governorates of Egypt.

4. Econometrics Analysis

4.1. The evolution of the indicators of digital transformation and the knowledge economy

A- in South Korea

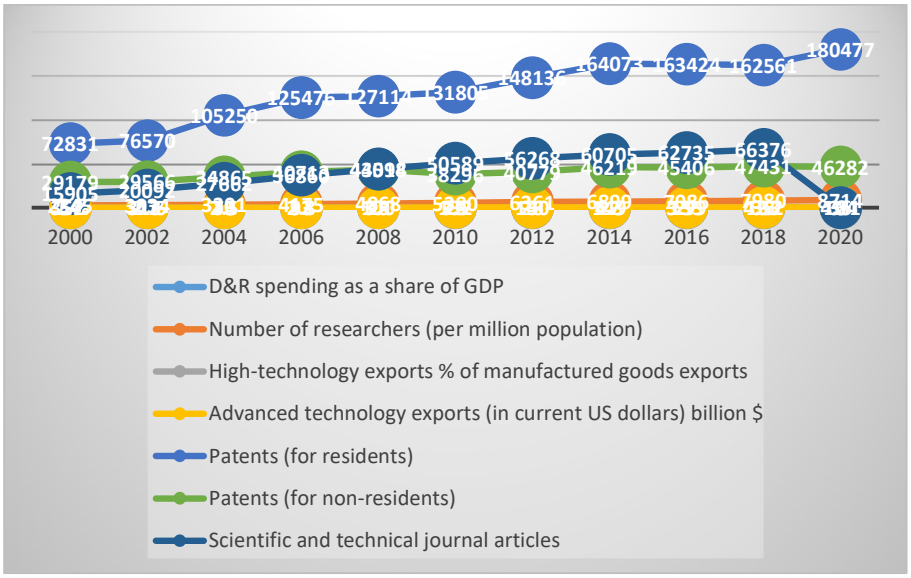

Figure (2) The evolution of the indicators of digital transformation in South Korea during the period(2020- 2000)

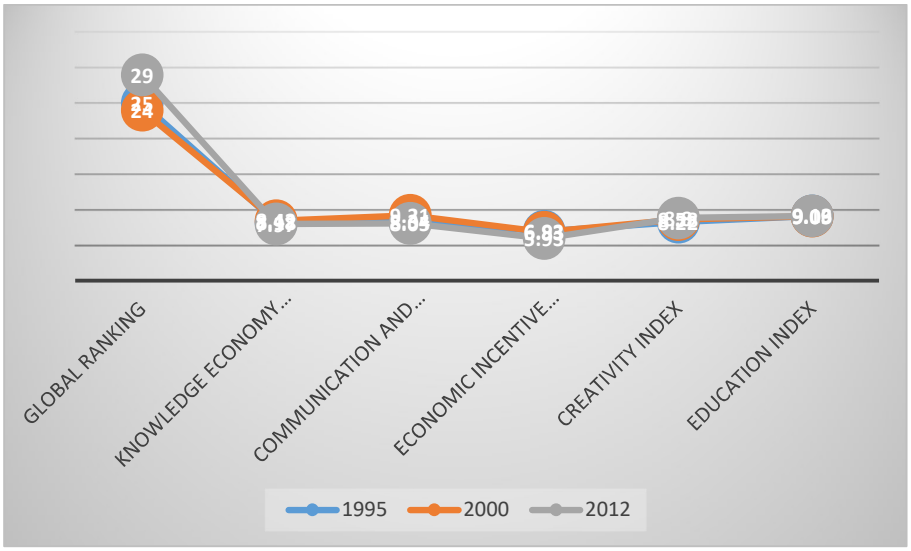

Figure (3) The evolution of the knowledge economy in South Korea during the period(2012- 1995)

B- in Egypt

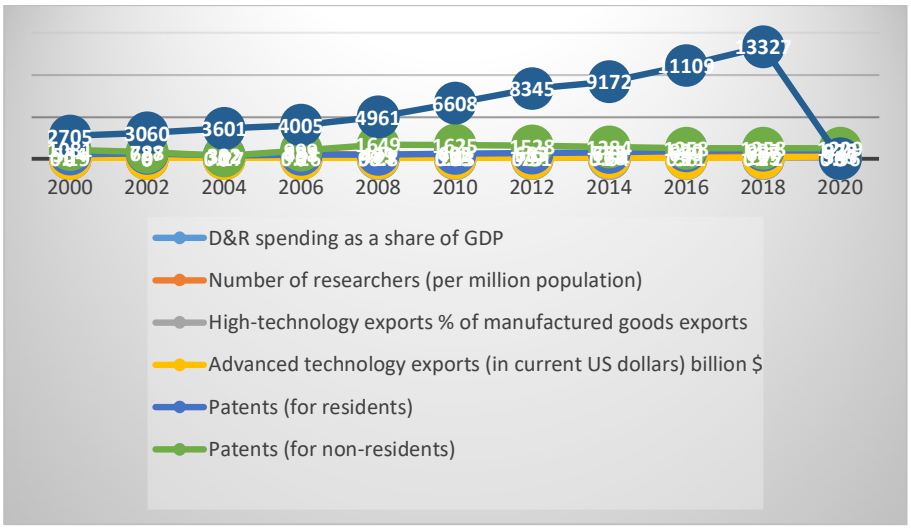

Figure (4) The evolution of the indicators of digital transformation in Egypt during the period(2020- 2000)

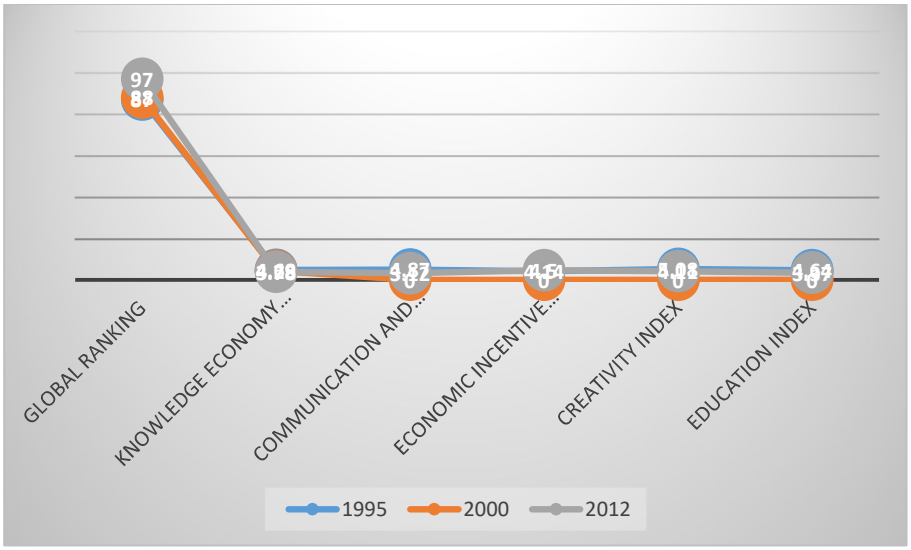

Figure (5) The evolution of the knowledge economy in Egypt during the period(2012- 1995)

C- in Iraq

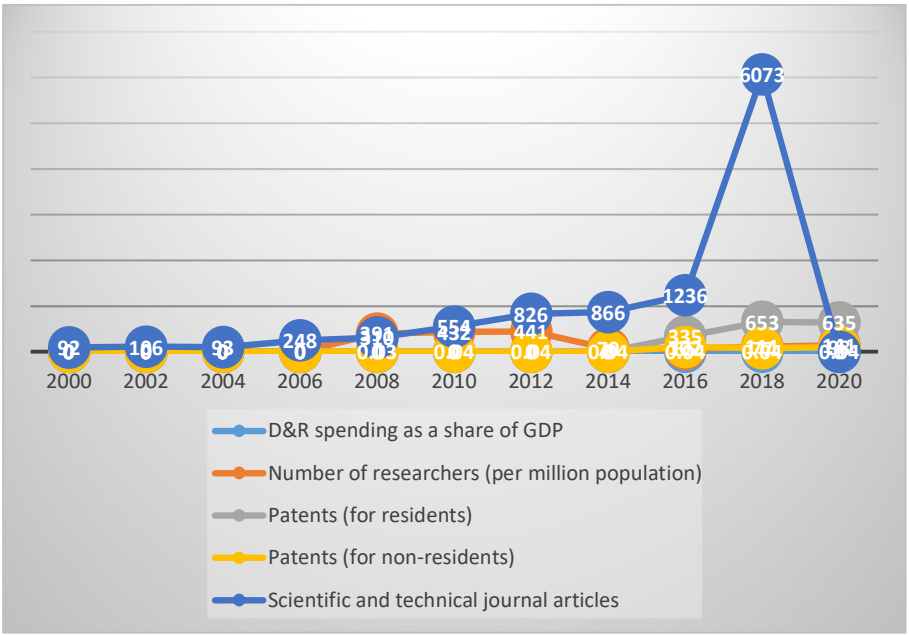

Figure (6) The evolution of the indicators of digital transformation in Iraq during the period(2020- 2000)

Internet users (per million people) during the period from 2010 to 2020

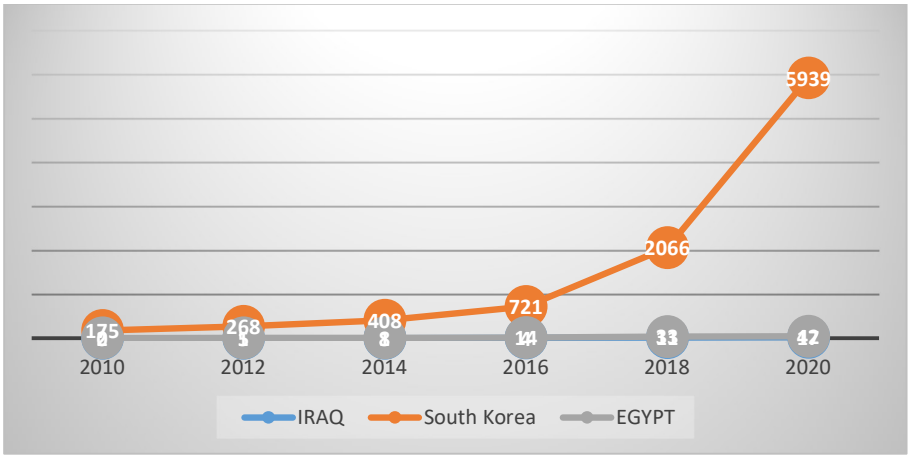

Figure (7) The evolution of the Internet users (per million people) during the period from 2010 to 2020

4.2.Standard relationships between the independent variable (digital transformation) and the dependent variables (knowledge economy)

In order to measure and analyze the effect of the independent variable (digital transformation) and the dependent variable (knowledge economy) were calculated through the use of a set of standard tests such as the extended Dickey-Fuller test, causality test and co-integration test to test the relationship between variables using E-Views.

- **in South Korea**

- **unit root test :** To measure the stability of the model variables, the developed Dickey-Fuller test (ADF) was used. Table (8) shows the stability of the digital transformation (X) at its level, which shows that the chain is integrated of zero degree, and it shows the instability of the knowledge economy (Y) at its level and stability occurred when the first difference was taken, which shows that the series is integrated of the first degree, and because the two series are complementary at two different degrees, the Ardle co-integration is used

Table (8) Developed Dickey-Fuller Test

Variables	Level			1st Difference		
	ADF	Sig.	Result	ADF	Sig.	Result
X	-7.225	0.000	stationary			
Y	-1.329	0.317	No stationary	-6.221	0.000	stationary

Source: E-views 12 program calculations

- **Causality Test :** It is clear that there are no two-way or one-way causal relationships between the variables at the significance level 0.05

Table (9) Causality Test

Prob.	F-Statistic	Obs	Null Hypothesis:
0.1399	2.21336	26	Y does not Granger Cause X
0.1434	2.18216		X does not Granger Cause Y

Source: E-views 12 program calculations

- **Bounds Test :** It turns out that there is co-integration between the variables at the significance level 0.05

Table (10) Cointegration Test

Null Hypothesis: No levels relationship F-Bounds Test				
I(1)	I(0)	Sign if.	Value	Test Statistic
	Asymptotic: n=1000			
3.51	3.02	10%	4.518192	F-statistic
4.16	3.62	5%	1	k
4.79	4.18	2.5%		
5.58	4.94	1%		

Source: E-views 12 program calculations

- **in Egypt : unit root test**

To measure the stability of the model variables, the developed Dickey-Fuller test (ADF) was used. Table (11) shows the stability of the digital transformation (X) at its level, which shows that the chain is integrated of zero degree, and it shows the instability of the knowledge economy (Y) at its level and stability occurred when the first difference was taken, which shows that the series is integrated of the first degree, and because the two series are complementary at two different degrees, the Ardle co-integration is used

Table (11) Developed Dickey-Fuller Test

Variables	Level			1st Difference		
	ADF	Sig.	Result	ADF	Sig.	Result
X	-6.253	0.000	stationary			
Y	-1.523	0.417	No stationary	-5.936	0.000	stationary

Source: E-views 12 program calculations

- **Causality Test :** It is clear that there are no two-way or one-way causal relationships between the variables at the significance level 0.05.

Table (12) Causality Test

Prob.	F-Statistic	Obs	Null Hypothesis:
0.6102	0.50869	26	Y does not Granger Cause X
0.6497	0.44244		X does not Granger Cause Y

Source: E-views 12 program calculations

- **Bounds Test :** It turns out that there is co-integration between the variables at the significance level 0.05

Table (13) Cointegration Test

Null Hypothesis: No levels relationship		F-Bounds Test		
I(1)	I(0)	Sign if.	Value	Test Statistic
	Asymptotic: n=1000			
3.51	3.02	10%	8.948742	F-statistic
4.16	3.62	5%	1	k
4.79	4.18	2.5%		
5.58	4.94	1%		

Source: E-views 12 program calculations

4.2.1. The impact of the independent variable (digital transformation) on the dependent variables (knowledge economy)

In order to identify the impact of the independent variable (digital transformation) on the dependent variables (knowledge economy) during the period study and to test the study's hypotheses, a simple regression equation was calculated between the independent variable (digital transformation) and the (knowledge economy) (dependent variable) during the period study

- **in South Korea :** It became clear the significance of the model, where the value of F was statistically significant at the level of 0.01 and the presence of a statistically significant impact of the level of (digital transformation) on the level of (knowledge economy) at the level of 0.01, and it was found that the independent variable (digital transformation) explains 70.5% of the changes that occur in the dependent variable (knowledge economy), while it returns The rest of the changes were for other variables that were not included in the model, and it was clear that there was a positive impact of the level of (digital transformation) on the level of (knowledge economy) and it was clear that there was a strong positive relationship between the level of (digital transformation) and the level of (knowledge economy), where the value of the correlation coefficient reached 0.840 and It was found that when the (digital transformation) increased by 1%, the level of (knowledge economy) increased by 0.632% and this explains the correctness of the first hypothesis of the study

Table (14) Impact of the (digital transformation) on the dependent variables (knowledge economy) in south Korea during the study period

b	t	F	r	R^2	P-VALUE
0.632	-19.371**	375.254 **	0.840-	0.705	0.000

- **in Egypt :** It became clear the significance of the model, where the value of F was statistically significant at the level of 0.01 and the presence of a statistically significant impact of the level of (digital transformation) on the level of (knowledge economy) at the level of 0.01, and it was found that the independent variable (digital transformation) explains 70.5% of the changes that occur in the dependent variable (knowledge economy), while it returns The rest of the changes were for other variables that were not included in the model, and it was clear that there was a positive impact of the level of (digital transformation) on the level of (knowledge economy) and it was clear that there was a strong positive relationship between the level of (digital transformation) and the level of (knowledge economy), where the value of the correlation coefficient reached 0.755 and It was found that when the (digital transformation) increased by 1%, the level of (knowledge economy) increased by 1.693%. and this explains the correctness of the second hypothesis of the study.

Table (15) Impact of the (digital transformation) on the dependent variables (knowledge economy) in Egypt during the study period

b	t	F	r	R^2	P-VALUE
1.693	14.431**	208.254**	0.755	0.572	0.000

5. Conclusion

- ✓ The statistically significant positive impact of the level of (digital transformation) on the level of (knowledge economy) in south Korea at the level of 0.01, and the value of the correlation coefficient reached 0.840 and it was found that when the (digital transformation) increased by 1%, the level of (knowledge economy) increased by 0.632% in south Korea and this explains the correctness of the first hypothesis of the study
- ✓ The statistically significant positive impact of the level of (digital transformation) on the level of (knowledge economy) in Egypt at the level of 0.01, and the value of the correlation coefficient reached 0.755 and it was found that when the (digital transformation) increased by 1%, the level of (knowledge economy) increased by 1.693% in Egypt and this explains the correctness of the second hypothesis of the study
- ✓ Work on the use of modern methods in the field of digital transformation and the use of modern technologies in the field of transition to the knowledge economy in Iraq
- ✓ Paying attention to studying the experiences that countries have undertaken in the field of digital transformation and how to achieve a knowledge economy, especially the experiences of Egypt and South Korea, and to benefit from the methods they used to overcome the challenges and difficulties they faced in this field.
- ✓ Great interest in education in general, providing appropriate support for technical education, setting educational plans related to the goals of economic development, and linking the outputs of the educational process to the requirements of the labor market, as South Korea did.
- ✓ Benefiting from international expertise specialized in the field of information technology, attracting multinational companies, foreign investment, technology transfer, and focusing on the technological side and high-tech exports.
- ✓ Providing the appropriate infrastructure and infrastructure for the telecommunications and information technology sector to suit the continuous changes and developments in this field, as Egypt did.
- ✓ Paying attention to creativity and innovation, increasing research and development expenditures, and encouraging new research and inventions.
- ✓ Provide an appropriate and appropriate institutional framework to attract international expertise and support institutions to confront corruption, and provide a good institutional and supervisory framework to reduce illegal operations.
- ✓ Focusing and paying attention to the pillars of the knowledge economy and setting long, medium and short-term plans and strategies to work on developing the pillars of the knowledge economy in a way that serves the transition to a knowledge economy, as South Korea did.
- ✓ Diversifying the economic structure so that it leads to diversifying the production structure and creating new income-generating sectors so that the total dependence on the revenues of the main sector in the economy decreases, and opens new areas with higher added value and is able to provide more productive job opportunities for the national workforce, and this will lead to raising growth rates in the long term'.

- ✓ Providing a comprehensive institutional entity to encourage innovation, research and development, and close linking with the business community, while coordinating the encouraging initiatives set for research and development.
- ✓ Building the knowledge economy must be done through a gradual system of the four pillars within a framework of coordination and integration with the economic phase that the country is going through, as gradualism helps to pay attention to education, absorb the technology workforce, supply education with modern technologies and then provide human capabilities Capable of dealing with the great development in global technologies.
- ✓ The effective role of the government in strengthening the foundations of the knowledge economy, such as the establishment of an independent ministry of the knowledge economy specialized in following up, developing and providing appropriate opportunities for projects and others, establishing research and development institutions, providing a modern information environment, encouraging investment in education and training and motivating the private sector to develop and enter the fields of information technology .
- ✓ Cooperate with international institutions interested in and supportive of the pillars of the knowledge economy, particularly the communications and information technology sector

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