

The role of the knowledge economy in human development in Sudan during the period from 1992 to 2022

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Abstract: The paper aims to identify the role of the knowledge economy in human development in Sudan during the period from 1992 - 2022 and the role of educational institutions in Sudan in transitioning to a knowledge economy, the paper assumed that the knowledge economy contributes to human development in Sudan, and that educational institutions in Sudan fulfill the requirements of building a knowledge society. The paper followed the deductive approach and the descriptive analytical approach to study the indicators of the knowledge economy, in addition to the comparative method to compare those indicators and then process them in order to reach Results: The paper reached conclusions, the most important of which is that the lack of the appropriate technical environment to stimulate the knowledge economy and material achievement in achieving human development in Sudan, and that the transition to knowledge economies still requires more effort at the level of all requirements in educational institutions. The paper recommended the necessity of linking education to the technology sector, keeping pace with the education outcomes of the knowledgebased economy, and increasing financial allocations in the general budget for education and scientific research, especially in the field of cognitive technologies, and providing the necessary funding for scientific research so that these institutions can perform their role in producing knowledge and achieving human development in Sudan.

Keywords: knowledge economy, human development, human capital, Economic development, sustainable development, Sudan.

دور الاقتصاد المعرفي في التنمية البشرية في السودان خلال الفترة من 1992 م - 2022 م

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المستخلص: تهدف الورقة إلى التعرف على دور الاقتصاد المعرفي في التنمية البشرية في السودان خلال الفترة من 1992 م - 2022 م، ودور المؤسسات التعليمية في السودان في التحول إلى اقتصاد المعرفة، وافترضت الورقة أن اقتصاد المعرفة يساهم في التنمية البشرية في السودان، وأن المؤسسات التعليمية في السودان تلي متطلبات بناء مجتمع المعرفة. واتبعت الورقة المنهج الاستنباطي والمنهج التحليلي الوصفي لدراسة مؤشرات اقتصاد المعرفة، بالإضافة إلى المنهج المقارن لمقارنة تلك المؤشرات ومن ثم معالجتها بهدف الوصول إلى النتائج: توصلت الورقة إلى استنتاجات أهمها أن عدم توفر البيئة التقنية المناسبة لتحفيز اقتصاد المعرفة والإنجاز المادي في تحقيق التنمية البشرية في السودان، وأن التحول إلى اقتصاديات المعرفة لا يزال يتطلب المزيد من الجهد على مستوى كافة المتطلبات في المؤسسات التعليمية. وأوصت الورقة بضرورة ربط التعليم بقطاع التكنولوجيا ومواكبة مخرجات التعليم في اقتصاد المعرفة وزيادة المخصصات المالية في الموازنة العامة للتعليم والبحث العلمي وخاصة في مجال التقنيات المعرفية وتوفير التمويل اللازم للبحث العلمي حتى تتمكن هذه المؤسسات من أداء دورها في إنتاج المعرفة وتحقيق التنمية البشرية في السودان.

الكلمات المفتاحية: اقتصاد المعرفة، التنمية البشرية، رأس المال البشري، التنمية الاقتصادية، التنمية المستدامة، السودان.

1- Introduction:

The knowledge economy has become a global economic model based on considering knowledge as an important element of production. The knowledge economy has leapfrogged the economies of countries that have adopted, planned and advanced it, as the progress and development of humanity is due to the development of its knowledge. Knowledge in today's economies is considered the main driver of competition and its impact on products and innovation, including scientific research and development, management preparation and development of human resources, as it is a complete economic process that includes production costs and productivity returns. The intelligence embodied in computer programs and technology has become more important than the importance of capital materials or labor. The United Nations estimates that knowledge economies constitute 7% of the global GDP and are growing at a rate of 10% annually. It is worth noting that 50% of productivity growth in the European Union, for example, is a direct result of the use and production of information and communications technology. The concept of the knowledge economy has witnessed significant development in the past few decades with the expansion of the use of the Internet, e-commerce and electronic payment. This economy is based on the existence of data that is developed into information, and then into knowledge, and thus choosing the most appropriate among the wide options offered by the knowledge economy, as the knowledge economy has become a decisive player in shaping the global economy

In Sudan, great leaps were achieved in the fields of education and the knowledge economy in the early nineties of the last century, as the major developments witnessed by the country in the fields of communications led to the liberalization of the communications sector, and investments entered this field, after the state exited and opened the opportunity to the Sudanese and foreign private sector. The number of Internet users in Sudan reached more than four million users, representing about 10% of the total population. Sudan became the fifth among 17 Arab countries with the highest Internet use until June 30, 2010. Sudan ranked fifth in the list of the five countries in Africa with the highest Internet use after Egypt, Morocco, Nigeria and South Africa. This indicates the rapid development of access to knowledge and information via the Internet in Sudan to advanced stages, and among the important bodies that sponsor this field in Sudan are the National Telecommunications Corporation, telecommunications companies, and the Sudanese Internet Society, and all of these bodies play roles in the field of knowledge economy in Sudan, and from this standpoint it has become necessary to evaluate the impact of knowledge economy indicators on economic growth and human development in Sudan. What role can the knowledge economy contribute to economic growth and human development in Sudan? What are the requirements of the knowledge economy that Sudan needs? Is the reality of the knowledge economy in Sudan sufficient to achieve human development

Paper hypotheses

The paper was based on the following hypotheses

1. The knowledge economy contributes to achieving human development in Sudan
2. Educational institutions in Sudan meet the requirements of building a knowledge society
3. The knowledge economy has helped develop knowledge capital in Sudan

Paper objectives

1. Identify the concept of knowledge economy and understand the role of education in it
2. Clarify the extent of availability of the requirements and elements of knowledge economy in Sudan
3. Identify the role of educational institutions in the transition to a knowledge economy

Paper methodology:

The paper used the descriptive, analytical and deductive approaches because they are suitable for the nature of studying knowledge economy indicators, in addition to the comparative approach to compare these indicators with the reality of the knowledge economy in Sudan, and then process them in order to reach the results. The paper also relied on secondary sources, previous studies, scientific journals and websites

Paper importance:

The theoretical importance of the paper is highlighted in its role in bridging the gap in the literature related to the study of knowledge economies in Sudan, by providing a comprehensive analysis based on data, and clarifying the importance and role of applying the knowledge economy and its impact on human development in Sudan. The practical importance of the paper lies in the possibility of stakeholders, such as the Ministry of Finance and Economic Planning and Higher Education, benefiting from its results and recommendations in improving policies related to knowledge economies and human development in Sudan.

Paper structure:

The paper included four axes: The first axis reviewed: The theoretical and conceptual framework and previous studies and deals with the concept of the knowledge economy, its importance and human development. The second axis: It dealt with the role of education and educational institutions in building a knowledge society. The third axis: analysis of indicators of both human development and the knowledge economy. The fourth axis: applying the indicators of the knowledge economy to human development in Sudan, then the results and recommendations.

Previous studies:

Many theoretical and applied studies have attempted to determine the impact of the knowledge economy on the dimensions of economic development and sustainable human development. The studies have demonstrated the importance of transitioning to the knowledge economy due to its effective contribution to achieving human development in countries through higher education institutions, as in the following studies:

1. Nasr El-Din et al. (2023) study on the knowledge economy and its impact on achieving sustainable development in the Kingdom of Saudi Arabia. The impact of the knowledge economy on sustainable development in the Kingdom of Saudi Arabia during the period (2000-2019), based on time series data, and to clarify the relationship between the variables, three models were described for multiple linear regression analysis, the independent variables were represented in the six knowledge indicators, and the dependent variables in the three dimensions of sustainable development, and the descriptive and standard approach was followed, using the ordinary least squares (OLS) method, and the results of the environmental dimension showed significant and positive all independent variables except for each of the net foreign investment flows, which turned out to be negative and insignificant, while the total patents showed the opposite and significant result. As for the results of the social dimension, the model was unable to explain the relationship between the dependent variable and the independent variables. Finally, the results of the economic dimension reached the significance and positivity of both net foreign direct investment flows and total enrollment in higher education, while the growth rate of per capita GDP and the local investment index were associated with the dependent variable with a positive but insignificant relationship. The variable of exports of technology, information and communication goods appeared with a negative and insignificant sign, and patents were negative and significant. The study recommended working to keep pace with technological developments to increase the Kingdom's competitiveness in innovation.
2. Fayez Ahmed Ali (2022), entitled The Role of Sudanese Higher Education Institutions in Achieving the Transition to a Knowledge Economy. The research adopted the descriptive analytical method. The research reached a number of results: The most important of which is that higher education institutions have a role in the level of educational requirements. Such as increased interest in owning infrastructure which has a role in terms of administrative and human requirements. Such as focusing on training students, professors, technicians, and administrators, and it has a role at the level of technical requirements, such as structuring rational public spending and increasing allocations to knowledge. The research recommended the need for the state to cooperate with higher education institutions in providing the necessary funding for scientific research, and the need to benefit from the experiences of European, Asian and Arab countries in the knowledge economy, and to work on concluding partnerships between local higher education institutions and their global platforms in order to achieve the goals of transferring, owning and localizing knowledge. And its production.
3. Attia's study (2021) The impact of the knowledge economy on improving the performance efficiency of human capital, a standard study on the Saudi economy for the period 2007-2018. Clarifying the concept and mentioning the indicators of the

knowledge economy and human capital in the Kingdom of Saudi Arabia for the period from 2007 to 2018, and adding the variables specific to the study, which are: the knowledge economy as a dependent variable represented by the value of transportation, storage and communications, and the independent variables consisting of spending on education as a percentage of national income and the total rate of enrollment in higher education and the percentage of families using the Internet and the number of articles in scientific and technical newspapers and the number of patents in the Kingdom. The inductive and deductive approach was used, and the standard approach based on the symmetric integration method using the ordinary least squares (OLS) method was followed to analyze the long-term relationship. The study concluded that some variables of the model are significant, namely the education spending index and the higher education enrollment index, while the rest of the variables are not statistically significant. The study also concluded a direct relationship between spending on education, the percentage of families using the Internet, the number of articles in scientific and technical newspapers in the Kingdom, and the total rate of enrollment in higher education. Thus, the study concluded that there is a positive relationship between the knowledge economy and improving the performance of human capital. The study recommended reviewing and developing the systems that influence the dissemination of science and knowledge in the Kingdom of Saudi Arabia, in addition to continuous investment in knowledge and minds, as they may be considered one of the largest sources of income in the Kingdom

4. Study: Amira Mohamed Ali Ahmed Hassan (2020) entitled the reality of the shift towards a knowledge economy at the Sudan University of Science and Technology from the point of view of faculty members). The problem of the study was to determine the reality of the shift towards a knowledge economy at the university under study at a time when the lack of interest in the knowledge economy is a reason that leads to the university not achieving its goals. The study aimed to identify and explain the extent to which the availability of the elements of the knowledge economy at the Sudan University of Science and Technology is affected by the requirements for achieving the knowledge economy in it and the university's trend towards the characteristics of the knowledge-based economy and the benefits that can be reaped the descriptive analytical approach was used as a tool to collect information. One of the most important results of the study is that the elements of the knowledge economy are available to a high degree at the Sudan University of Science and Technology, and that the faculty members' awareness of the requirements of the knowledge economy is very high, and that the characteristics of the trend towards the knowledge economy are also very high, as are the benefits of the existing economy On .knowledge
5. Study: Omar Hassan Abdel Rahman (2019). It is a study entitled (The role of Sudanese universities in building a knowledge society - the University of Khartoum as a model). The problem of the study was to ask about the availability of elements that help in the processes of disseminating and producing knowledge at the University of Khartoum and to ask about the available opportunities, threats and risks that exist in the external environment of the University of Khartoum, which positively and negatively affect the university's role in building the knowledge society in Sudan. The study aimed to investigate the role played by Sudanese universities, represented by the University of Khartoum, in building the knowledge society in Sudan and producing knowledge at the university. The study used the case study approach to describe the current situation at the University of Khartoum. It also used SWOT analysis as a method and tool to demonstrate the strengths, weaknesses, opportunities, and threats that positively and negatively affect the extent of the University of Khartoum's ability to play its role in building the knowledge society. By conducting a SWOT analysis of the data, the study reached a set of elements that represent strengths and weaknesses, as well as factors that represent available opportunities and those that represent threats to the role of the University of Khartoum in disseminating and producing knowledge. To activate the role of the University of Khartoum in building the knowledge economy, the study recommended developing a strategic plan for the scientific research process at the university and motivating the research faculty members financially and morally so that they can effectively contribute to building the knowledge society in .Sudan
6. The study of Bin Dhafra and Al-Abdi (2019) The impact of human resource development on exports in the Kingdom of Saudi Arabia focused on analyzing and measuring the impact of human resource development on exports and its contribution to the gross domestic product (GDP) in the Kingdom of Saudi Arabia for the period (2000-2017), using time series data, to explain the relationship between the dependent variable, represented by total exports, and the independent variables, represented by oil and non-oil exports, GDP, spending on human resource development, and total government spending. The descriptive

analytical approach was used, and through the statistical methodology and the autoregressive model (VAR). The study found a long-term equilibrium relationship between the variables, and the study concluded that spending on human resource development and non-oil exports for one lag period have a positive and significant impact on total exports. However, there was a relative decline in oil exports relative to total exports. Accordingly, the study recommended increasing the contribution of non-oil exports instead of relying on the oil sector in order to achieve sustainable development, in addition to that. She recommended the need to direct spending towards educating and qualifying females, as they represent half of society, in line with the Kingdom of Saudi Arabia's Vision 2030.

There are studies that focused on the impact of the transition to the knowledge economy on economic development, as in the study:

7. Laila Ayyad et al. (2018). Titled: Standards for measuring and evaluating the knowledge economy and their role in activating the economic development process. The problem of the study was how the knowledge economy contributes to achieving economic development at the Arab, Islamic and international levels. It aimed to explain the variable of the knowledge economy qualitatively and quantitatively by presenting the criteria for measuring it and how to apply it to some Arab, Islamic and foreign countries, noting the difficulty of defining a typical and comprehensive measure for each. Specific standards for the knowledge economy. The study followed the descriptive analytical approach to reach several results, the most important of which are: The issue of using knowledge effectively and paying attention to intellectual capital is considered the main concern of various societies in order to keep pace with the growing knowledge revolution and absorb and adapt it to national needs in light of global environmental changes, and that the development of the knowledge economy is based on providing a knowledge database and accurate measurements of specific indicators according to the nature of each economy and its available resources.

Previous studies differed in their focus on specific aspects of the knowledge economy such as education, information and communication technology, and human capital. They also differed in measuring the impact on economic growth and development in general, but they agreed in providing strong and clear evidence of the existence of a relationship between the application of the knowledge economy and the development of human capital. The current study was distinguished by its specialization in measuring the impact of the knowledge economy on human development in Sudan, using indicators of the knowledge economy and its impact on the economic growth of the country as a whole, in addition to the study's reliance on the descriptive approach in measuring and extracting results, and providing a detailed and comprehensive view of the concept of the knowledge economy and how to apply it to serve the development of human development in Sudan.

The first axis: The theoretical and conceptual framework:

First: The concept of knowledge economics:

A. The concept of knowledge:

Knowledge is the result of science, and science consists of information composed of information, and information comes from data. Knowledge of reading is the result of receiving information about letters and events in its simplest form. It is data given by God Almighty to humans to express a specific thing, and the person discovered it in himself used it, and developed it.

Knowledge is one of the important modern production factors for creating wealth in the modern economy, after the traditional economy relied in its analysis of wealth creation on the main factors of production: land, labor, and capital. Knowledge is capital based on ideas, experiences, and best practices, meaning that it is in the modern economy the important factor. In the production of wealth, the scarcity of knowledge and the stagnation of its development indicate that the countries that suffer from it have weak production capacity and diminished development opportunities, to the point that the knowledge gap is what has become considered the main determinant of the capabilities of countries in the view of the World Bank, and developing countries suffer, especially Arab countries, which have become not only From the knowledge gap, but from the knowledge production gap . (Hoda, Adnan, 2012).

B. The concept of knowledge economics:

The knowledge economy is the economy in which knowledge achieves the greatest part of the added value. Accordingly, knowledge constitutes an essential component in the production process, just as in marketing, and growth increases with the increase of

this component. Also, this type of economy is based on information and communication technology, as the basic platform on which it starts from it. (Ibrahim, 2019) .

The term knowledge economy appeared at the beginning of the 1960s to describe the transformation of traditional economies into economies in which the production and use of knowledge is important through the accumulation of knowledge and the development of science and technology and the information and communications sector. The Organization for Economic Co-operation and Development (OECD) defined knowledge economies as economies based on distinct knowledge, based on the distribution, production, and use of knowledge and information, high-technology investments, industries with modern technology, and achieving gains in associated productivity.

There is no clear concept to define the term “knowledge economy”. The Organization for Economic Cooperation and Development defines knowledge-based economies as those that depend directly on the production, distribution and use of knowledge and information. The basic determinants of the knowledge economy include the rate of the economy’s dependence on intellectual capabilities more than its dependence on material inputs or natural resources in the context of integrating new knowledge at every level of the production process. Achieving a knowledge-based economy requires moving from a materialistic conception of the economy to a conception that exploits the potential of innovation, human capital, and knowledge. and new technologies. The successful transition to a knowledge based economy often depends on the following four basic elements: long-term investment in education, innovative skills, updating the information base, and creating a favorable business environment. The knowledge-based economy is also a combination of four interconnected elements, which are the acquisition of knowledge through scientific research, its subsequent transfer in the education process, its dissemination through information and communication technology, and its use in technological innovations. There are four pillars of the knowledge economy, which are: innovation, research and development, education, infrastructure built on information and communications technology, good governance.

Second: Human development and knowledge economies:

The concept of human development is based on the fact that “human beings are the true wealth of nations” and that human development is the process of expanding people’s options, and “Choices” express a higher concept, (Nader, 1999).

The term human development confirms that the human being is the tool and goal of development. Human development considers economic growth a means to ensure the welfare of the population. Human development is nothing but a process of development and expansion of the options available to the human being as the essence of the development process itself, that is, it is the development of people by people and for people. (Mohamed Jabbar 2007) .

The goal of development is not simply to increase production, but to enable people to expand their choices to do more, live longer and better lives, and avoid treatable diseases. Thus, the development process becomes the process of developing practical capabilities and maximizing benefit or economic welfare as it is viewed today. The basis for sustainable human development is not only material welfare, but also raising the cultural level of people, allowing them to live more and better lives, exercise their talents, and advance their abilities. It is clear here, for example, that education and culture achieve moral and social benefits that go far beyond their productive benefits, from self-esteem to the ability to communicate with others to improving consumer taste.

The concept of human development and sustainable development are not far removed from the concept of economic development according to the criterion of national income. They are the result of the same traditional approach, assuming that there is a single pattern of development that must be followed by all countries, and development in it is not possible except through the transfer of capital and technology. This is considered The traditional approach: Local and national characteristics are barriers and obstacles to development, and investment in physical capital is the key to it, and the economic structures resulting from this investment are the only ones capable of producing development, and the human aspect in it occupies a marginal space and the vision in it is always short-term. In addition, the Both the concepts of human and sustainable development are characterized by their limitations and that they are short-term. This is because the two concepts did not include all the life aspects of development. For example, human development was limited to the economic and human aspects of development, while sustainable development was limited to the economic and environmental aspects of development. (Lawrence, 2005) .

Thus, there was a need for a broader concept of development that combines the concepts of economic, human and sustainable development, concerned with the environment, population, energy, technology, social institutions and other aspects, not only within

their current situation, but also within a long-term perspective, as well as the need for a concept that corrects the mistakes of the traditional approach mentioned above. By linking environmental and human capital with social capital, this is a concept that recognizes diversity and accepts the possibility of the existence of several parallel patterns that all lead to development, and the possibility of each country choosing the development approach that it deems appropriate for it to achieve the same long-term development goals that everyone seeks to achieve, and it is therefore an approach. Priority is given to deduction and innovation rooted in previous experiences, and then the traditions and characteristics of each country become a source of wealth and enrichment and an entry point to the development process and not a barrier in its path. (Hoda ,Adnan (2010).

Third: Human capital theories:

The systematic focus on human capabilities came through the research of the American economist (Theodore Schultz) in the fifties and sixties, when he discovered on the sidelines the role of experience and acquired skills as a general factor in the growth of labor productivity, which is what later became known as human capital, that is, the increase in production resulting from Institutions, educational programs and others that contribute to increasing the productivity of the worker or employee,

This scientific development, within the context of the prevailing trend in economics, led to interest in man and his energies, but from the perspective of his role in serving the production process and not the other way around. There is no doubt that this interest in human capital at the academic level coincided in industry with the shift to advanced technology and the labor it requires skilled specialist and intensive capital investment in developing human capabilities. Since the 1950s, investment in developed countries in human capital in all its forms has become greater than investment in physical capital such as machinery, equipment, infrastructure, and the like, which is the necessary introduction to the shift towards what is known today as the knowledge or technological economy. "Part of the educated labor offer depends on the concept of private investment in education, and the theoretical foundations are many, including: (Website (2003).

1- Investment theory: Education raises productivity:

Calculating rates of return is based on levels of education in developed and developing countries (individual and social rates), and elements such as: lifetime income, unemployment expectations, experience, and tax. The human capital theory has been deficient in a number of aspects, including:

- Assuming a perfect market which is not the case in terms of competition or wages.
- Assuming that education increases productivity and that productivity is a characteristic of the worker.
- The inability of human capital variables (education and experience) to partially explain income variables satisfactorily.
- Income differences according to race, gender, family background, and work position...
- The existence of other, non-economic, goals of education.

Which prompted the emergence of other theories or explanations for wage differences between workers.

2- The theory of competition for work: This theory assumes:

- A. Productivity is not a characteristic of the individual, but rather a characteristic of work (technology).
- B. Education reveals the learner's abilities to adapt and learn.
- C. The employer is ready to train his workers to fill the jobs necessary for him (the internal market).
- D. The employer is willing to pay a high wage to those with skills to retain them (special training)
- E. The worker agrees to remain in the waiting line in order to get a good job.

3- Labor market segmentation theories:

It is an assumption and a test of the existence of several separate labor markets, including:

- A. An independent primary labor market in leadership frameworks: (in which there is a turnover of workers)
- B. A primary labor market subordinate to management and production frameworks: it has relative stability and is not creative.
- C. A secondary labor market for less-skilled workers: it has turnover because it is marginal.
- D. Technology determines the business and thus the characteristics of the workers required to fill it.

The issue, then, is not one of financial ability as much as it is mobilizing social cards. Social status is what determines the fate of people. Countries that drew development plans based on financial investment faltered, while China advanced economically because it applied the principle of self-reliance, that is, social investment, which is represented by human development.

The latter is what compensated for the lack of financial investment, and this is what we find in the experience of China, which relied on so-called social investment, making it a pioneering experience in how to employ the human element.

The second axis: The role of education and educational institutions in building a knowledge society.

The knowledge economy is based on obtaining and sharing knowledge with the aim of improving the quality of life in its various fields by benefiting from information services and advanced technological applications, using the human mind as knowledge capital, and employing scientific research to bring about a set of strategic changes in the nature and organization of the economy so that it becomes more responsive and harmonious with the challenges of globalization. Information and communications technology, universal knowledge, and sustainable development in its comprehensive sense. In order to achieve the knowledge economy, there must be a conscious community infrastructure, the preparation of workers and knowledge makers who possess knowledge and have the ability to analyze and innovate, and employ an effective system for research and development, in addition to providing broad electronic connectivity and easy access for community members to the information network, and spreading the culture of the learning society in thought and application in various institutions Educational and economic. (Omar 2016).

The knowledge society is that society that is essentially based on disseminating, producing, and employing knowledge efficiently in all areas of societal activity, economics, civil society, politics, and private life, in order to steadily improve the economic situation that is establishing human development.

Educational institutions, especially universities, play a leading role in building knowledge societies by adding to the stock of human knowledge through scientific research, development and innovation. We find that these institutions, especially universities, occupy a distinguished position in the literature written about the characteristics of the knowledge society and the indicators that indicate the existence of the knowledge society. This comes as a result of the pivotal role that these institutions play in the process of producing knowledge through scientific research and innovation and in the process of disseminating knowledge through teaching and education and publishing the results of scientific research so that they can be used in the process of economic and social development. We find that universities in developing countries, including Arab countries, face many challenges and obstacles that hinder them from effectively contributing to building the knowledge society for various reasons. In addition to teaching and scientific research, educational institutions, especially universities, play a new role in building a knowledge society, the most important of which is serving the community, studying its problems, and working to solve them, as well as interacting with other institutions and companies in the private and public sectors and creating partnerships with them in order to exchange benefits and experiences and market the results of scientific research. This is with the aim of achieving economic and social development and contributing to building a knowledge economy and society, (Omar . op, cit. 2016).

Education and training:

The most important key to desired economic growth is education and training led by the principles of equality and inclusiveness. There is a need to shift to an educational system that focuses on arming students with the skills necessary for a knowledge-based economy, such as:

1. Research and lifelong learning skills.
2. Critical thinking skills.
3. The ability to adapt and keep pace with the rapid development in information and communications technology.

The aforementioned skills are a summary of many skills that enable students to adapt within the knowledge economy society.

The skills can be generally detailed as follows:

1. Basic skills: including reading and writing, arithmetic operations, and basic computer operations.
2. Communication skills: include oral and written expression, presentation skills for the purposes of dialogue, negotiation, persuasion, influence, and consultation.
3. Thinking skills: These include cognitive skills, such as: analysis, problem solving, evaluating situations, making suggestions, employing them, and making decisions, and meta-cognitive skills, such as: control, direction, and balancing.
4. Team work skills: This includes cooperating with others and working in teams.
5. Behavioral skills: include adapting to situations, taking risks, responsibility, and innovation.

6. Information gathering skills: These include identifying, collecting, analyzing, balancing, organizing, and presenting information.

The role of universities in building, achieving and nurturing the transition to a knowledge economy can be monitored by adopting the following points:

1. Awareness and training.
2. Stimulate innovation.
3. Partnership with industry and orientation towards product research with technology and scientific solutions to development problems.
4. Incubating and assisting in transferring technology to the market and protecting the rights of innovators.
5. Contributing to measuring and evaluating government performance in this field.
6. Providing solutions to the obstacles to transformation of the knowledge society.
7. Focus on comparative advantage and achieving real breakthroughs.

The role of educational institutions in creating knowledge and achieving human development:

The role of educational institutions is no longer limited to providing, producing, and disseminating knowledge, and research and innovation only. Rather, it has become a guiding force for economic growth and a major tool in transferring accumulated human cultural and scientific experience. The importance of higher education is increasing in today's world, where knowledge resources prevail over material resources as factors in development. (Fayez ,2023) .

To create knowledge, it is necessary to develop a strategic vision for higher education that is based on achieving structural synergy for the triple combination of its functions in human development, social development, and sustainable economic development. At the level of human development, education must work for enlightenment and not to establish hegemony, the dominance of the other, and demand silence from the recipient. Education is not based on the spoken word but on empirical reality education that does not rely on narration and oral representations, but rather is based on the method of scientific disclosure of objective reality. Education based on questioning and questioning instead of education based on rote memorization and storing information. education based on reading, research and development. Finally, an education that does not reinforce authority hierarchy, and subordination relationships, At the level of social development, education means working for modernity to inspire its values and traditions, even if we are forced to establish scientific research centers, to transmit the thought of modernity and for the independent exercise of the Arab mind. With regard to economic development, the role of higher education in the Arab world is focused on meeting the needs of the market stimulating economic growth, improving industry productivity through an educated and skilled workforce, and creating investment opportunities in knowledge industries that are based on intellectual and human capital.

Educational transformations within the concept of the knowledge economy:

Education within the concept of the knowledge economy has brought about major transformations in education according to the traditional situation, and these transformations can be seen through the following table: (Khaled , 2015).

Table No. (1) most prominent educational transformations within the concept of the knowledge economy.

Education according to the traditional situation.	Education according to the concept of knowledge economy.
Literal verbal education	Education by doing and applying
Education by memorization	Education by acquiring experience, abilities and competencies
Creative thought	Creative cognitive thought
Focus on the past and ancient theories	Focus on the future and contemporary theories
Paper education	E-learning and paper
Education based on local culture.	Education based on diverse cultures
Education according to traditional methodological methods	Education according to contemporary methodological methods such as discussion circles, brainstorming, transfer and sharing of knowledge

Education according to the traditional situation.	Education according to the concept of knowledge economy.
The role of the indoctrinated teacher and the main source of education	The role of the teacher is the discussant and inspirational teacher
Measuring academic achievement as an introduction to stereotyping	Comprehensive assessment of the learner's personal aspects and creativity, and the school is part of the educational network in the community
A recurring curriculum of subjects	A renewed curriculum that includes many study subjects that simulate actual and practical needs
Repetitive, stereotyped knowledge that focuses on one form of knowledge.	Procedural knowledge that seeks to achieve competitive advantages by focusing on technical knowledge

Source: Khaled Ajeel Al-Hashash, *The Knowledge Economy: Sustainable Wealth*, Dar Al-Kitab Al-Hadith, Cairo, 2015, p. 32.

The third axis: analysis of indicators of both human development and the knowledge economy.

Human development indicators: In 1990, the United Nations Development Program presented a report on human development, which became the basic alternative to the vision of development that is equated with economic growth. Many efforts were made for this change, which is that eradicating poverty has become a multidimensional activity, as poverty is more from just a lack or lack of material well-being, it is also related to ill health, poor education, deprivation of knowledge and communication, inability to exercise human and political rights, and loss of dignity, confidence and self-respect. It is usually believed that the ability of individuals to access technical innovations, transportation, telephone, or the Internet increases with income, and this is true. Economic growth creates opportunities to find and disseminate useful technical innovations, but this process can take place in reverse. Investment in technology, like investment in education, can provide individuals with better tools, which helps increase their productivity and well-being, and then technology becomes a tool and not just a reward or a result of growth and development.

In fact, the unprecedented gains of the twentieth century, whether in human development or in eradicating poverty, can be attributed to technical discoveries. Human development is an important means of technical development and technical innovation is an expression of human potential, and higher levels of education make particularly strong contributions to the creation and dissemination of technology when larger numbers of scientists engage in research and development.

Knowledge economy indicators:

There are a number of indicators through which the knowledge-based economy can be measured, including: (Khaled Yassin, 2015).

1. Investment in the knowledge-based economy index: The composite index for investment in the knowledge-based economy addresses the generation and dissemination of new knowledge, which are two crucial dimensions of investment, and the index is calculated based on a set of sub-indices related to research and development efforts, such as investment in human capital, the quality of education, purchase of new technologies, and the modernization of public services.
2. Performance in the knowledge-based economy: Investment is one aspect of the components of the issue, and it should give completely successful and profitable outcomes, and while the composite index for investment groups its sub-indices under knowledge generation and dissemination, the second index identifies the four most important components of performance in order to move to the economy. Knowledge-based: These elements are productivity, scientific and technological performance, use of information infrastructure and effectiveness of the educational system.

The knowledge economy has indicators determine it is the prevailing pattern in an economy and indicate the extent of success in moving towards it, which enables comparisons to be made between countries to determine the level of economic development they have reached. They include indicators that measure knowledge inputs, their stock, networks, dissemination, outputs and management, including: (Fayez, op. cit. 2023.)

1. The percentage of the knowledge component in the price of goods, services and products.
2. The country's trade balance with regard to knowledge trade, knowledge exports and knowledge imports including the technological balance of payments by type of technology.

3. Indicators of the trend towards the information society, such as infrastructure indicators (phones, computers, networks, including the Internet), digital content, and the extent of progress in implementing information and communications technology applications in the fields of commerce, government, and education.
4. Number of patents and intellectual property rights, including trademarks.
5. The number of years of study and training in relation to the individual's age.
6. The proportion of spending on research and development as a percentage of the gross domestic product, and the number of researchers in relation to the population.
7. The number of technology, research or science parks and the number of technology incubators.

Knowledge economy indicators can also be classified according to four different categories, which are as follows:

- A. Science and technology indicators such as data on research and development, patent statistics, scientific publications, balance of technological payments and information and communication dissemination indicators.
- B. Indicators from research on the organization of innovation activities: Research on innovation has always been conducted by national bodies to respond to their own needs, and therefore it has been difficult to compare results.
- C. Indicators related to human resources: The importance of variables related to human resources for knowledge economies is recognized by everyone. However, there are still very few well-known indicators to study this dimension of the knowledge economy. This is due, on the one hand, to the lack of work in this field, and on the other hand, to the difficulty of measuring competencies. Individuals directly and human resources indicators have two main sources: data related to education and training, and data related to competencies or workers' occupations.
- D. Indicators of ICT diffusion: ICT diffusion data are numerous and very diverse, but they contain major defects. They are difficult to compare from one country to another, and one source to another, and they are often not very reliable. The hardware and software infrastructure of the "digital economy" is not yet properly measured, in fact it does not provide companies with ICT accounts, and these shortcomings are only partially compensated for by specialized research.
- E. Patents are an indicator of technical activity in the sense of benefiting from scientific knowledge and research results and transforming them into practical technology that benefits the industrial sector and society.

According to the United Nations Human Development Report, it is clear that the process of registering patents depends on the nature of the country and the importance it attaches to patents. For example, the number of patents registered by Japan has reached 1,000 patents per million people, while in Sweden it has reached 200 patents per million people, even though the percentage of spending on research and development in Sweden has reached 4.5% of the national product. This is more than Japan spends (3.2%) of its national product. It is also clear that some countries may spend on research and development a rate that may reach 1% of the national product, but their percentage of patents has reached 100 patents per million people. This is similar to other countries that spent on research and development at rates exceeding 2.5% of the total national product. As for the Arab countries, patents do not exceed one patent per million people, and this calls into question the reasons for the significant decline in the technological returns of scientific research. Below is a table of some indicators of the trend towards the knowledge economy and the gross domestic product in Arab countries in 2009. (Maitha, 2007)

Table No. (2) indicators of trend towards the knowledge economy and gross domestic product in Arab countries, 2009.

Country	Mobile phone subscribers per 100 people	Internet users per 100 people	Mobile phone subscribers, one million subscribers	GDP at current prices is billion dollars	Country	Mobile phone subscribers per 100 people	Internet users per 100 people	Mobile phone subscribers, one million subscribers	GDP at current prices is billion dollars
Jordan	99.8	26	6	22.943	Sudan	36.1	10.2	15.4	63.690
U. A. E	153.8	75	10.7	225.631	Somalia	7	1.2	.064	-
Bahrain	119.2	53	1.4	20.595	Iraq	64.2	1.1	19.7	98.987
Tunisia	94.5	34.1	10	43.551	Oman	146.1	5.15	4	46.115
Algeria	93.7	11.2	32.7	139.520	Palestinian	45.8	32.2	1.8	-

Country	Mobile phone subscribers per 100 people	Internet users per 100 people	Mobile phone subscribers, one million subscribers	GDP at current prices is billion dollars	Country	Mobile phone subscribers per 100 people	Internet users per 100 people	Mobile phone subscribers, one million subscribers	GDP at current prices is billion dollars
Comoros	17.1	3.6	0.123	--	Qatar	122	43	2	98.313
Libya	152.2	10.8	9.5	63.769	Kuwait	146.5	36.9	3.9	109.482
Syria	50	13.8	10	52.297	Lebanon	57	23.9	2.4	33.47
Egypt	69.4	24.3	55.4	187.848	Morocco	80	41.3	25.3	90.515
Mauritania	64.6	2.3	2.2	3.029	Saudi	167.4	38	44.9	369.178
Djibouti	14.8	4	0.129	1.104	Yemen	35.6	10	8.3	29.922

Source: International Telecommunication Union website, 2009 www.itu.int

The fourth axis: applying knowledge economy indicators to human development in Sudan:

Applying indicators for measuring the knowledge economy to Sudan in the field of human development and the development it has reached in the field of the knowledge economy through measuring performance indicators that measure knowledge inputs and its stock of knowledge:

1. The quarter-century strategy for higher education:

In 2003, the state developed a quarter-century strategy for higher education and scientific research in Sudan, whose goals were: (Zakaria, 2005).

- Preparing highly skilled graduates and responsible citizens capable of meeting the requirements of the country's development direction and reformulating curricula and curricula in a manner consistent with those directives and the country's current and corresponding needs.
- Rooting the sciences and emphasizing the status of the Arabic language, the English language, and other languages.
- Giving priority to technical education and developing it to reach 60% of higher education.
- Expanding enrollment in universities to enable reaching the global proportion of the age group expected to enroll in higher education.
- Participation of higher education in building a culture of peace to ensure justice based on the right to satisfy the basic needs of individuals.
- Encouraging private education to have broad participation in spreading education in accordance with global and local changes and developments.
- Investing in research to achieve economic and social goals and taking into account research in basic sciences, which is considered a starting point for future innovations, while ensuring a balance between them and applied research.
- Developing universities to become centers of excellence in research and development and establishing units of a special nature and centers for future studies in them.
- Attention should be given to selecting and preparing researchers within the framework of postgraduate studies, which should be given increased attention and development in all universities.
- Activating the role of the university and conducting studies and research to keep pace with the expected changes in the field of higher education.

2. Promoting higher education:

The interest in promoting higher education in Sudan is not a new thing. In 2010, the Ministry of Higher Education and Scientific Research presented a vision whose purpose was to "improve" higher education and scientific research in the country. Professor Fathi Muhammad Khalifa, Minister of State at the Ministry of Higher Education and Scientific Research at the time, stated in that vision that achieving the goals of higher education with regard to (scientific research) is represented in the following points. (Fathi, 2010).

- Rearranging the situation in institutions of higher education and scientific research requires developing an integrated vision for scientific research in universities.
 - We want scientific research that sets priorities, produces research that is published and applied on the ground to bridge the gap between what is known and what is practiced.
 - Scientific research without publishing it is a waste of money, time and potential.
 - Published scientific research is not enough, it must be applied.
 - Deanship of Scientific Research at the university, to coordinate scientific research programs in the colleges.
 - A budget for scientific research (25%) of the university's budget.
3. Availability of technical infrastructure:

Technical education is considered the basis and backbone for advancing development and development in various countries of the world. This type of education is characterized by its direct connection to meeting the needs of the labor market, as it contributes to upgrading the economic and social reality on the one hand and following up on the latest developments in technical development on the other hand.

Sudan is considered one of the countries that has a history and legacy in all fields of education. Sudanese schools and even its universities have become widespread in all parts of the country. We need to develop education and rehabilitate its infrastructure in general, and we also need to complete the infrastructure of universities, especially state universities, so that they can fully play their role in carrying out scientific research related to development and services so that they can play an important role in advancing the rural economy. (Zakaria, op. Cit. 2005).

4. Educational and communications technology applications:

Information and communications technology is what facilitates the dissemination and processing of information and knowledge and its adaptation to local needs to support economic activity and stimulate projects to produce high added values. This structure is an important element in bringing about the change necessary for the transition to the knowledge economy, as it is the basic tool through which individuals in the knowledge society can to communicate with all new knowledge. (Mustafa, 1997).

Information and communications technology indicators are of great importance because they include a number of details that are related to technology and the economic aspect at the same time. Most modern industrial and service sectors benefit from audio-visual media and computer devices and networks. These means and devices, and related services, have become a large proportion of the volume of international trade and total industrial output in many developed countries.

Despite the great development that Sudan has witnessed in communications, computers, and the Internet, the relationship between them and the knowledge economy is still weak, and this is confirmed by the weakness of the knowledge economy index in Sudan, which reached about 1.78 in 2010. We would also like to point out the weakness of the relationship between economic growth and the evidence of the knowledge economy in the Arab countries and Sudan until 2010. These data confirm the weakness of benefiting from knowledge and its outcomes in development, and that benefiting from technological methods and the knowledge economy must stand side by side with other means of developing the economy Sudanese, (Fayez, op. cit . 2023).

5. Percentage of spending on research and development:

Scientific research began in Sudan in 1902 with the establishment of public health laboratories, followed by the establishment of an agricultural research unit in 1904. Interest in scientific research continued with the opening of the College of Medicine in 1924, the opening of the College of Agriculture and Veterinary Medicine in 1930. and then the establishment of the University of Khartoum. However, the established scientific activity was codified by the establishment of the National Research Council in 1930. 1970 followed by the establishment of the National Research Center in 1991. and the allocation of a Ministry of Science and Technology in 2001. There are a number of channels specialized in scientific research in Sudan, represented by the Ministry of Higher Education and Scientific Research, which includes 27 government universities, institutes and colleges, 50 private universities and colleges, and the Ministry of Science and Technology, which has six research bodies and centers and three specialized departments. (Hind ,2009).

It was stated in the report of the Secretary-General of the Union of Arab Scientific Research Councils for the year 1988 that the budget for scientific research in Sudan witnessed a significant increase in the period from 1972 ~ 1973/ 80 ~ 1981, amounting to 3.45%. The budgets were allocated in that period as follows:

- 65% research units sector.
- 18% independent research units.
- 15% public service units.
- 12% higher education institutes.

The report estimated spending on research and development in 1984 at \$19.9 million, equivalent to about 3% of the gross domestic product. This rate decreased to 15%, about 75 million Sudanese pounds, in 1990 ~ 1991. as stated in the comprehensive national strategy. (Faisal , 2000).

The percentage of education (ministries and institutions) for scientific research during the period (1999 ~ 2001) was 7.37%, while funding at private expense reached 3.55%, and there is 7% funding that will not be mentioned. To avoid this dilemma, a budget and a percentage of the national income must be allocated to scientific research and attract the sector. To contribute to financing scientific research and from the results of research and researchers to develop various areas of production, taking into account linking scientific research plans to the training budget. (Hind , op. cit.2009).

Analysis of the reality of the knowledge economy in Sudan:

- Although the features of the knowledge economy in Sudan that were mentioned previously, they were not sufficient for Sudan to achieve development in this field. Sudan's ranking in the knowledge economy at the world level in the year 2021 is 145, and at the level of the Arab countries it is 15, and this is what the following table shows it:(Abdul Wahab ,2001).

Table (3) ranking of Arab countries in Global Knowledge Index for the year 2021.

Global ranking	Country	the value	Global ranking	Country	the value
11	U. A. E	67.3	101	Morocco	43.5
38	Qatar	58.7	103	Jordan	42.5
40	Saudi	57.6	106	Palestinian	42
48	Kuwait	54.5	111	Algeria	40.3
52	Oman	52.3	137	Iraq	33
53	Egypt	52.3	145	Sudan	30.4
55	Bahrain	52.2	147	Mauritania	29
83	Tunisia	47.2	150	Yemen	28.4
92	Lebanon	44.8			

Source: United Nations Development Program 2021 www.undp.org

In view of the current situation of the Sudanese economy, it should be emphasized that it is still experiencing the pre-launch phase that East Asian countries experienced, and this negates the validity of the first hypothesis which states that the knowledge economy contributes to achieving human development in Sudan.

- Building the national capabilities of educational institutions in Sudan requires considering the components of higher education, quantitative and qualitative training, and directing graduates of higher education according to the needs of economic and social development. This confirms the validity of the second hypothesis, which states that educational institutions in Sudan meet the requirements of building a knowledge society.

The connection between economic and social development with global and regional transformations and the readiness to enter a new humanitarian phase portends multiple dangers economically, politically, morally and culturally, which requires that the capacity building program in the field of education and human resources be responsive to all these transformations.

This confirms the validity of the third hypothesis, which states that the reality of the knowledge economy in Sudan has helped in developing knowledge capital.

Results:

1. Lack of the appropriate technical environment to stimulate the knowledge economy and material achievement in achieving human development in Sudan.

2. The transition to knowledge economies still requires more effort at the level of all requirements in educational institutions.
3. Technical requirements are the most available requirements for developing knowledge capital, while financial requirements are the least available requirements in higher education institutions.
4. Administrative instability at the state level has a negative impact on meeting the requirements of the transition to a knowledge economy and achieving human development.
5. Sudan's lack of openness to international higher education institutions has delayed its transformation into a knowledge economy and achieving sustainable human development.

Recommendations:

1. Linking education with the technology sector and keeping pace with the education outcomes of the knowledge-based economy.
2. Increase financial allocations in the general budget for education and scientific research, "especially in the field of cognitive technologies."
3. Providing the necessary funding for scientific research so that these institutions can perform their role in producing knowledge and achieving human development.
4. Establishing centers for research and patents, and encouraging and motivating researchers financially and morally.
5. Establishing investment projects that can transform into a knowledge economy and achieve human development.

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