

THE CONTRIBUTION OF EDUCATION ECONOMICS TO INNOVATION THROUGH THE HUMAN CAPITAL IN ALGERIA

مساهمة اقتصاديات التعليم في الابتكار من خلال رأس المال البشري في الجزائر

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Abstract: This research aims to measure the contribution of education economics to innovation through human capital in Algeria. The analytical descriptive approach was used in the study. The results showed that education economics contributes to the global innovation index in Algeria through the second most important standard for measuring it: human capital and research during the last seven years (2018-2024). However, the value of human capital and research was not up to what is required, considering Algeria's untapped manpower. In addition, many data for sub-indicators of education are not available, which negatively impacts this rate.

Key Words : Education Economic; Human Capital; Innovation; Indicators.

Résumé : L'objectif de cette étude est de mettre en évidence la contribution de l'économie de l'éducation à l'innovation par le biais du capital humain. Pour cela, une approche descriptive-analytique a été utilisée. Les résultats indiquent que l'économie de l'éducation a contribué au taux d'innovation mondial en Algérie sur une période de sept ans (2018-2024), en tant que deuxième critère le plus important parmi sept critères de mesure du taux d'innovation pour chaque pays. Cette contribution est attribuable à un potentiel humain inexploité en Algérie et à un manque de données sur les indicateurs secondaires de l'éducation, ce qui a eu un impact négatif sur le taux d'innovation. En effet, le capital humain et la recherche ont été identifiés comme les principaux moteurs de l'innovation dans le pays, soulignant ainsi l'importance de l'économie de l'éducation pour favoriser la croissance économique et le développement à long terme.

Mot clé : Economie de l'Education; Innovation; Capital Humain; Indicateurs.

ملخص: تهدف هذه الدراسة إلى إبراز مساهمة اقتصاديات التعليم في الابتكار من خلال رأس المال البشري، تم استخدام المنهج الوصفي التحليلي في الدراسة، وأظهرت النتائج أن اقتصاديات التعليم تساهم في معدل الابتكار العالمي في الجزائر من خلال مؤشر رأس المال البشري والبحوث خلال الفترة (2018-2024) باعتباره ثاني أهم معيار من بين سبعة معايير لقياس معدل الابتكار لكل دولة لم يكن في المستوى المطلوب نظرا لما تتمتع به الجزائر من طاقات بشرية غير المستغلة استغلالا صحيحا بالإضافة إلى أن هناك العديد من البيانات للمؤشرات الفرعية للتعليم غير متوفرة مما ينعكس سلبا على هذا المعدل. الكلمات المفتاحية: ابتكار، اقتصاديات التعليم. رأس مال بشري، مؤشرات.

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I- Introduction :

Knowledge and information have become increasingly central to modern economies, acting as key drivers of production and economic growth. This economic transformation has been characterized by several key developments: the rise of information and communication technology, an increased focus on human development, and the recognition of human capital as the primary source of knowledge. This shift marks a transition from an industrial economy (based on tangible assets) to a knowledge economy (centered on intangible assets such as expertise and intellectual property). The human element has become paramount in this new economic paradigm, particularly due to its role in knowledge creation and dissemination—what we now term "human capital." To develop this human capital effectively, quality education at all levels is essential. This requires establishing a system that ensures quality from early childhood education to higher education and university education. The educational system plays a crucial role in the life of nations by meeting their need for human capital, which shapes their present and lays the groundwork for future development. It is also responsible for preserving, enriching, and developing cultural heritage. A strong link exists between development and education, as education is one of the factors of production that drives growth and economic development.

The Arab Human Development Report highlights that educational quality remains a significant challenge, particularly in its ability to enhance the quality of life and nurture human creativity, this research aims to highlight the contribution of education economics to innovation through human capital in Algeria by addressing the following key question: **To what extent does education economics contribute to innovation through human capital in Algeria?**

Research Methodology:

The research utilized a descriptive analytical approach to examine education economics and its role in fostering innovation through human capital. This involved reviewing and analyzing data on human capital and innovation to establish the interconnected and symbiotic relationship between education economics, as reflected in human capital, and innovation. Moreover, the study was divided into three axes: the first axis represented the conceptual framework of education economics, the second was innovation, and the third was the contribution of education economics to innovation.

I.1. Education Economics:

Education Economics is a branch of economics that examines the economic aspects of education as part of the educational process, including education and training at all levels, as well as in-service training for workers and the unemployed labor force seeking employment. The education economics is concerned with the expenditures and revenues of education, as well as the relationship between expenditure and benefit at both the individual and national economic levels. The education economics examines education from an economic perspective through the study of human resource economics, education in light of economic objectives, analysis of the material return on education compared to cost, educational productivity, and measuring outputs in relation to inputs. (Ghanem, Mahani, 2006).

One of the most important issues in analyzing the mutual relationships between the educational system and its institutions is the issue of educational investment, which clearly reflects the essence of the relationship between education and economic and social development. This issue has gained increased attention since the emergence of human capital theory, which emphasizes the importance of educational investment through what is known as the education economics, by analyzing both the inputs and outputs of the educational process. This analysis contributes to the development of the educational system and its institutions both currently and in the future. Many countries have

benefited from being guided by the theory of human capital to enhance their educational strategies (Abdullah, 1998).

The interest in human capital dates back to the nineteenth century, when a group of economists highlighted the role of education in increasing the wealth of society. Perhaps the most important of these economists is Adam Smith, who is considered the first to point this out in his book "The Wealth of Nations." He stated that the useful knowledge and experiences acquired by individuals constitute their fixed capital and a part of the wealth of the society to which they belong (Smith, 1776). Alfred Marshall, in his book "Principles of Economics," indicated that education plays a role in developing the intellectual abilities of individuals, in addition to discovering existing talents, which are considered a wealth owned by society. (Alfred, 1930).

The American economist Mincer was the first to use the term "human capital" in the 1960s (Mincer, 1958). While Schultz laid the initial foundations for the concept of human capital through his famous lecture "Investment in Human Capital," in which he considered education an investment in human capital (Schultz, 1960), Becker G.S. came in 1964 to establish the foundations of the human capital theory, pointing to the impact of human capital on economic variables (Becker, 1964).

In the 1980s, the "endogenous growth" theories emerged from Romer in 1986 and Lucas in 1988, presenting models of the economic growth process to clarify the impact of human capital on long-term growth (Romer, 1986; Lucas, 1988).

I. 2. The Concept of Human Capital:

There are several definitions of human capital that we will address; some of them are as follows:

- Becker defines human capital as "the sum of the talents, experiences, and knowledge of the individual, embodied in their innovative and productive abilities."
- Schultz defines it as "human capital is the education the individual has received, expressed in their ability and valuable information, and is a renewable resource."
- The Organization for Economic Co-operation and Development (OECD) defines human capital as "the innate knowledge and skills of the individual that they work to develop throughout their lives, which they use to innovate and produce goods and services in the market or beyond."

In light of the above, human capital can be defined as "the set of diverse human knowledge, experiences, and skills that the individual has acquired through education, training, and practice, which they use to achieve the organization's objectives" (Ziane, 2018).

I.3.innovation:

Arnold Toynbee sees that one of the most fundamental sources of society is innovative individuals, and Albert Einstein agrees that the world needs those who provide new knowledge to humanity and work to develop it for application, which is called innovation. It can be defined as "the introduction of new ideas or the reshaping of existing patterns of knowledge to solve specific problems." Innovation is not limited to the technical aspect but also includes manufacturing methods and improvements in the organization itself.

The Arab Philosophical Encyclopedia defines innovation as "the production of something new or the formulation of existing elements in a new form in one of the fields of science, arts, and literature." The New Britannica Encyclopedia defines innovation as "the ability to find a new solution to a problem." The term innovation is attributed to the Austrian economist Joseph Schumpeter since 1912, who is considered the first theorist of innovation. He defines it as "the

result of creating a new method or technique of production, as well as changing all the components of the product or how it is designed." Peter Drucker defined it as "a change in the yield of resources and a change in the value and satisfaction resulting from the resources used by the consumer." Thinkers differ on whether innovation is a new idea that has not been recounted before or a method that differs from the usual. Based on the above, innovation can be considered a new idea that has been embodied in reality. Here, we distinguish between creativity and innovation, as the former is the presentation of a new idea that has not been addressed before, while the latter is the embodiment of this idea in reality (Ziane, 2018).

II. The contribution of education economics to innovation through human capital:

II.1. The Global Innovation Index Indicators:

It is evident from Table (1) that the Global Innovation Index (GII) is calculated based on seven main criteria, each of which includes three key indicators. Each key indicator is further divided into a total of 81 sub-indicators, collectively reflecting aspects such as political stability, ease of business creation and bankruptcy resolution, education expenditure as a percentage of GDP, average years of schooling, freedom of movement for international students in universities, university rankings, access to information and communication technology (ICT), e-government services, public infrastructure, capital, GDP, environmental performance, credit, investments, loans, trade and market scope diversification, local industry diversification, university-industry research and development collaboration, strategic alliances, patents, intellectual property, foreign direct investment, research talent, labor productivity growth, software expenditures, quality certifications, knowledge dissemination, advanced technology exports, trademarks, creative goods and services, mobile application creation, and more.

From Table (2), it can be observed that Algeria's Global Innovation Index value dropped by approximately 4 points in 2020, reaching 19.48, which represents a decline of 11 global ranks compared to values exceeding 23 in 2018 and 2019. This decline is primarily attributed to the COVID-19 pandemic, alongside the transitional phase experienced by the country during this period. However, the index reached its highest value in 2021, amounting to 24.41 and ranking 120th globally. It then dropped by 4 points to 20.95 in 2022 due to a decline in the Human Capital and Research criterion from approximately 30 to 26, as well as a decrease in the Creative Outputs criterion from 10.3 in 2021 to 7.7 in 2022. Despite this, Algeria advanced to 115th globally and 10th in the Arab region, with Saudi Arabia ranking first among Arab countries and 51st globally. This apparent contradiction can be explained by significant index declines in many other countries.

The index reached its lowest value in 2023, recorded at 16.1, which is 4 points lower than its 2022 value, with Algeria falling to 119th globally. This drop is linked to a 10-point decline in the Human Capital and Research criterion. In 2024, the index value increased slightly by 0.1 compared to the previous year, advancing in rank to 115th globally. However, Algeria ranked only 12th in the Arab region, largely due to a decrease in the Market Sophistication criterion from 13.9 to 5.2.

II.2. Indicators for Calculating Human Capital and Research:

From Table (3), it is clear that the Human Capital and Research and Development Index is calculated using three main indicators: education, tertiary education, and research and development. The education indicator includes the following sub-indicators: expenditure on education as a percentage of GDP, education spending as a percentage of GDP, government expenditure per student at the secondary level as a percentage of GDP, expected years of schooling, PISA tables (assessing students over the age of 15 in reading, mathematics, and science), and the student-to-teacher ratio, which are among the most widely used indicators for measuring the quality of

education. The tertiary education index is calculated based on the percentage of students enrolled in higher education, the percentage of graduates in engineering and science, and the degree of internal mobility of foreign university students. These indicators are crucial for university rankings in both QS and The Times Higher Education rankings.

Table 4 shows that the Human Capital Index experienced a relative increase, rising by about 4 points between 2018 and 2021, reaching a value of 29.8, the highest recorded during the five years, and moving up six ranks to 74th place globally. However, there was a decline of almost 4 points in 2022, dropping to 82nd place globally, the lowest position attained during the five years. This decline is attributed to a significant drop in the percentage of graduates in science and engineering, from 34% to 29%, as well as a decline in the Research and Development index, which was 5.2 in 2021 and fell to 3.2 in 2022. The lowest value of the index was in 2023 at 16, with a global rank of 113th, due to a decrease in education contribution to 11.3%, compared to 40.9% in 2022. However, in 2024, the index rose again by 12 points from the previous year, reaching a value of 28.1 and occupying 76th place globally.

Human capital and research contribute 14.3% to the global innovation rate, meaning that each one-point increase in the Human Capital and Research and Development Index results in a 14.3-point increase in the innovation rate.

III-Conclusion:

The world is currently characterized by constant change, an explosion and acceleration of knowledge, the rapid transfer of information in brief moments, and ongoing interaction between countries and cultures. Many new and recurring problems have emerged for which humans do not have ready-made solutions. Innovation plays a crucial role in diagnosing these problems and developing alternative solutions that align with these changes.

Human societies, especially developing ones, need to invest in the productive capacity of their people. They cannot remain mired in technological dependence; they must contribute to achieving this technological development. Human resources are one of the most important of these capacities, as human capital is considered one of the means and factors contributing to economic growth. Recent empirical evidence suggests that a more skilled and educated workforce is one of the essential requirements for achieving higher economic growth.

Therefore, the education economics is concerned with the processes by which education is produced and distributed among competing individuals and groups, determining the level of spending on education by both individuals and society, and assessing the types, results, and quantitative and qualitative adequacy of education. Through the presentation of the Global Innovation Index, which primarily focuses on educated human resources, technology, and patents, we find that human capital plays a significant role in contributing to its increase or decrease, as it is the second most important criterion for measuring innovation.

In Algeria, despite the recent upward trend, human capital and research indicators remain below the required level, given the country's young talents and capabilities. One of the most prominent reasons for this decline is the lack of clear indicators measuring the quality of education, which is considered the most important element in building human capital. In most years, according to the Global Innovation Index report, the sub-indicator values for the human capital and research criterion, such as the percentage of expenditure on education from GDP and the student-teacher ratio, are not available for Algeria, negatively impacting the true value of the indicator. To achieve innovation indicators that can compete globally, it is necessary to focus on the development of human capital through education by defining clear indicators and providing the necessary data to address and correct areas of imbalance.

IV- Appendices:

Table (1) :Innovation Measurement Indicators

Indicators	Sub-Indicators
Institutions	– Institutional environment – Regulatory environment – Business environment
Human capital and research	– Education – Tertiary education – Research and development (R&D)
Infrastructure	– Information and communication – Technologies – General infrastructure – Ecological sustainability
Market Upgrading	– Credit – Investment – Trade, diversification and market scale
Business sophistication	– Knowledge workers – Innovation linkages – Knowledge absorption
Knowledge and Technological Outputs	– Knowledge creation – Knowledge impact – Knowledge diffusion
Creative Outputs	– Creative goods and services – Intangible assets – Online creativity

Table (2): Innovation Indicators During the Period (2018-2024)

Year	2018		2019		2020		2021		2022		2023		2024	
Innovation_Index	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
	23.87	110	23.98	113	19.48	121	24.41	120	20.95	115	16.1	119	16.2	115

The source: global innovation index report (2018,2019,2020,2021,2022,2023,2024)

Table (3): Indicators for Calculating Human Capital and Research

Indicators	Sub-Indicators
Education	– Expenditure on education as a percentage of GDP

	– Government funding/pupil, secondary, % GDP/cap – School life expectancy, years – PISA scales in reading, maths and science – Pupil–teacher ratio, secondary
Tertiary education	– Tertiary enrolment, % gross – Graduates in science and engineering, % – Tertiary inbound mobility, %
Research and development (R&D)	– Researchers, FTE/mn pop. – Gross expenditure on R&D, % GDP – Global corporate R&D investors, top 3, mn USD – QS university ranking, top 3*

The source : global innovation index

Table (4): Human Capital and Research Indicator During the Period (2018-2024)

Year	2018		2019		2020		2021		2022		2023		2024	
Huma n Capita l and Resear ch Indicat or	Sc ore	Ran k	Sc ore	Ran k	Sc ore	Ran k	Scor e	Ra nk	Sc ore	Ran k	Sc ore	Ra nk	Scor e	Ran k
	25.9	80	27.9	74	28,4	74	29,8	74	26.1	82	16	113	28.1	76

The source: global innovation index report (2018,2019,2020,2021,2022,2023,2024)

V - Referrals and references:

Abdullah, A. (1998). *Modern Sociology of Education – Evolutionary Origin, Theoretical Approaches, and Modern Field Studies*. University Knowledge House, Alexandria, Egyp

Becker G. S,(1964), "Human Capital ", Colombia University , press for the National Bureau of Economic Research, New York.

Ghanayem, Mahna M. (2006). *The Fields and Importance of Education Economics*. Al-Ma'arifa Journal, Issue 157, Saudi Arabia. Publisher: Ministry of Education.

Lucas R. E, (1988),"On the Mechanics of Economic Development", *Journal of Monetary Economics*, vol 1, N°22.

Mincer. J,(1958), "Investment in Hunan Capital and Personal Income Distribution", *Journal of Political Economy*.

Rowaya, H. (2003). *A Strategic Approach to Planning and Developing Human Resources*. University Publishing House, Alexandria, Egypt.

Romer P. M.,(1990) "Endogenous Technological Change", *Journal of Political Economy*, Vol 98, N°5, University of Chicago Press.

Smth. A, (1776), *'Recherche sur la nature et les causes de la richesse des nations'*, G. Garnier, Trad., Université Chicoutimi, Québec, Canada.

Schultz T.W, (1960), "Capital formation by education", *Journal of Political Economy*.

Ziane, A. (2018). *The Impact of Human Capital on the Productive Performance of the National Electronic Industries Corporation*. *Journal of Strategy and Development*, Vol. 8, No. 15.

Ziane, A. (2018). *The Importance of Supporting Innovation in Algeria through University-Industry Partnership*. *Al-Muntada Journal for Economic Studies and Research*, Issue 3.