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Reality Of Innovation And Knowledge Economy In Light Of Global Innovation Index 2023 : A Case Study Analysis of Algeria

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Abstract:

This study examines the reality of innovation and knowledge-based economy through the analysis of the WIPO Global Innovation Index 2023 for the case of Algeria. A comparative content analysis approach was adopted to analyze the results of 80-GII indicators, compiled under 7-pillars and compare the latter with the official statistics of the Ministry of Higher Education and Scientific Research. The study concluded by identifying the strengths and weaknesses, as well as the possible challenges and opportunities in order to improve Algeria's ranking in the GII and achieve the desired sustainable development. The findings revealed that although Algeria stands at a low rank (R-119), it has achieved very encouraging results for some key indicators such as institutions, infrastructure and human capital development, which would further support the role of these indicators in accelerating innovation and promoting the transition towards a knowledge economy in a way that serves sustainable development and knowledge society.

Keywords: *Global Innovation Index, Innovation, WIPO, Knowledge Economy.*

Introduction:

The Innovation Index is an important measure of a country's ability to innovate and identify areas that need improvement. A country can enhance its development and raise living standards of its people by relying on reviewing and correcting weaknesses and strengths for the purpose of complying with the GII. The index compiles a series of indicators that measure numerous aspects of innovation, including ; research and development (R&D), patents, SMEs and start-ups, scientific publications and citations, and other related output of a knowledge-based economy. It plays an important role in measuring a country’s progress in the field of innovation, and identifying areas that need improvement to attract high-quality foreign investment and boost the overall competitiveness in order to improve the quality of life and well-being and lift people out of poverty. As identified in last year's GII Data, the GII report showed that the results were not surprising since at first analysis. As for the general results of GII 2023, the most innovative countries in the world made it to the top 10 out of 132 ranked

economies in the GII, whether with regard to the geographic region or the per capita income class, while the rest world economies witnessed progress or decline in the classification to varying degrees. As for Algeria, the innovative performance declined by four degrees. The index demonstrated that Algeria ranks 119th out of 132 economies in the GII 2023, while it had been ranked the 115th out of 132 ranked economies in the GII within the year before. As will be seen herein, some key indicators should be prioritized by Algeria to move up the GII score, and thus, Algeria's global economy ranking. For this, the present study is a comparative content analysis of the year-on-year GII data changes of Algeria's economy to determine the key indicators' strengths and weaknesses to accelerate as a knowledge-based economy.

Definitions:

1. ***Innovation:*** the American economist Joseph Schumpeter regarded innovation as a radical technological innovation that lead to profound changes in productivity, stimulate economic growth, create businesses in the industrial and service sectors, and improve social welfare (Maureen, 2000; 1). It is also known as the practical application of an invention or the process of making or developing a new commodity to make it more economically viable (Efendi, 2022).
2. ***Innovation Index:*** this year in its 16th Edition, the GII is a leading reference for measuring an economy's innovation ecosystem performance. The index published annually, it is also a valuable benchmarking tool used by policymakers, business leaders, and other stakeholders to assess progress in innovation over time. It measures the pulse of innovation against the backdrop of an uncertain economic and geopolitical environment. The GII 2023 edition takes the pulse of innovation against a background of an economic and geopolitical environment fraught with uncertainty. It reveals the most innovative economies worldwide, ranking the innovation performance of approximately 132 economies and underlying innovation strengths and weaknesses. Overall, the GII provides the most comprehensive overview of the state of the landscape of innovations and in this way, it comprises around 80 indicators, including measures of each economy's political environment, education, infrastructure and knowledge creation. The various metrics that the GII serves help to monitor performance over time and to benchmark developments against economies within the same geographic region or per capita income class (Global Innovation Index 2023 - WIPO GII; < wipo.int/gii>).
3. ***Knowledge Economy:*** the Organization for Economic Co-operation and Development (OCDE, 1996) defines it as an economy that directly depends on the production, distribution and use of knowledge and information (Menad, 2021). The knowledge economy or knowledge-based economy (KBE) relies on using knowledge as a basic resource in economic activity. KBE basic activities are generating, sharing and managing knowledge, in addition to investing in human resources, which contributes to the formation of intellectual capital (IC) and the extensive use of information and communications technology (ICT) as a tool for interaction of economic organizations with their internal and external environments (Bouqmoum, 2018).

Global Innovation Index (GII) pillars:

GII contains two (02) Sub-Indices—Innovation Input Sub-Index and Innovation Output Sub-Index—that are composed of 7-pillars and 80-indicators.

1. *Innovation Input Sub-Index:*
   Institutions: measures the suitability of the institutional environment for innovation, including government stability, judicial effectiveness, and intellectual property protection;
2. *Human Capital and Research:* measures the level of education and skills in the workforce, in addition to the number of researchers and the amount of research and development (R&D) expenditure;

   Infrastructure: measures the quality of infrastructure, including roads, transportation, electricity, and the Internet;

3. *Market Sophistication:* measures the market efficiency, including size, ease of new entry, and presence of competition;
4. *Business Sophistication:* measures the favorable business environment for innovation, including the ease of starting a business and capital investment.
5. *Innovation Output Sub-Index:*
6. *Production of knowledge and technology:* measures the number of scientific publications, patents, and technology developments;
7. *Creative Outputs:* measures the number of films, books, designs and other creative products;

The overall GII is computed by taking a simple average of the scores of the two indices —the innovation input index and the innovation output index.

A Preliminary Extrapolation of Algeria's position in GII 2023

The Global Innovation Index 2023 (GII) results confirmed differences in knowledge gap size between the countries that have made a tremendous strides in building a knowledge-based economy and those that are still lagging behind. The world's most innovative economies have maintained their positions in recent years not only by geographic region but also by per-capita income class. According to GII 2023 data, Algeria's economy has a year-on-year decline in innovation performance with an overall GII score of 119 out of 132. A year ago, its rank was 115th out of 132. The country has seen, however, a noticeable decline in innovation performance, lagging behind other sub-regional leaders of 04 places as compared to GII 2022 rankings released by the World Intellectual Property Organization. The latter preliminary extrapolation, in fact, gives grounds for questioning the fundamental reasons for this decline!.

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Table 01: Algeria's position in GII 2023

	GII Position	Innovation Inputs	Innovation Outputs
2020	121st	111st	126th
2021	120th	109th	128th
2022	115th	110th	118th
2023	119th	118th	116th

Source: Global Innovation Index (GII) 2023 -WIPO [Free Report]

- **Position:** Algeria placed at the 119th position out of 132 economies on the annual Global Innovation Index 2023. The country has been placed at the 18th position in terms of the geographic region (North Africa and West Asia- NAWA); and the 33rd position in terms of income level (among the lower middle income – (LMI) country group). From that data, the classification was based on two main factors: (i) *Geographic Region*; and (ii) *Per Capita Income Class*. As for the regional classification, seven (07) basic regions have been identified as follows: South-East Asia Region (SEAR) and East Asia (EAR); North Africa and West Asia (NAWA); Latin America and Caribbean (LAC); Central and South Asia (CSA); Europe Region (EUR); and Latin America (LATAM). For the income level, four (04) income classes have been approved: —low, lower-middle, upper-middle, and high-income economies.

Classification results according to GII pillars

The 7- GII pillars classification scale results are shown in Table 02 below. The average rank indicates best to worst in descending order. Institutions, infrastructure, creative outputs, human capital and scientific research, business sophistication, market sophistication, knowledge & technology outputs range, respectively; **97**, 102, 107, 113, 120, 125, **128** (best to worst) in the scale.

Table 02: 7- GII pillars classification scale results

GII Pillars / Classification	Institutions	Infrastructure	Creative Outputs	Human Capital and Scientific Research	Business Sophistication	Market Sophistication	knowledge & technology outputs
GII 2023 Classification	97	102	107	113	120	125	**128**

Source: prepared by the researchers depending on GII 2023 -WIPO [Free Report]

As it is clear from table above, the innovation output sub-index includes two major pillars: (1) Institutions results and (7) Knowledge and technology-based results. Algeria ranks 97th in institutions pillar index, which is considered the best compared to the six other GII pillar indices. The Institutions pillar captures the presence of a good institutional environment that supports innovation, given the fact that to the recent trends of the Algerian government with regard to supporting innovation, emerging institutions and promoting the culture of entrepreneurship and startups. The issue is however not limited only to support innovation performance, but rather to enact laws that legally frame and manage the issue along the lines of the Ministerial Order Nº 1275 (*Degree, Start-Up/Degree, Patent*) to enhance the institutional framework of the economy. Algeria ranks 102nd in infrastructure pillar index, indicating that the infrastructure that supports innovation has witnessed significant dynamism in recent years. Algeria has the 107th position in the creative outputs pillar indicating the weakness that the country's economy witnessed for diving into a creative production. The knowledge economy project is obviously still in its starts and requires some effort and extra time to reach quite fair creative output provision that would reasonably contribute to provide an added value to the country's knowledge economy. Algeria ranks 113th in human capital and scientific research pillar index results, which is evidence that human capital and scientific research support innovation. The country's economy still has a weak value, especially in creative and innovative human capital. Despite the good results in size of human capital in universities and institutes, and the percentage of those with training in the fields of engineering and technology, yet the value is clearly not appreciable, and indeed the country still some way from joining the big league of innovative economies compared to regional and worldwide peers. According to the table results, Algeria ranks 120th in business sophistication, indicating the lack of a business environment that supports innovation in a sufficient manner to add value to the economy and become a productive factor with a social and economic impact. Besides, the country takes the 125th position in market sophistication, which is a very logical result in the absence of a real product and knowledge and innovation based economy outputs, as marketing the latter is considered one of the biggest challenges facing knowledge-based economy since Algeria is subject to a rentier economy that lacks other diverse supply sources and relies mainly on petroleum. Addedly, it placed the 128th position in Knowledge and technology outputs pillar index, indicating a weak production. This is therefore absolutely normal in comparison with the absence of market sophistication and a weakness in most of the previous indicators related to the inputs.

Table intertwining the innovation pillars results with the classification criteria:

The table shows the classification results according to the innovation index pillars intertwined with results by geographic region and others by per capita income level. It is noteworthy that the state of Algeria is classified with the North Africa and West Asia region and with a lower middle-income level classification. Generally, Algeria's result was lower than the average outputs for either geographic region or income level for all GII pillars except the first three indicators in which Algeria obtained the results that were close to the results of regional and worldwide peers.

Table 03: innovation pillars results and classification criteria

27,60	**51,51**	**06,72**

GII Pillars / Classification Standards	Institutions	Human Capital and Scientific Research	Infrastructure	Market Sophistication	Business Sophistication	knowledge & technology outputs	Creative Outputs
GII 2023 Classification	97	113	102	125	120	128	**107**
Top 10	56,27	92,82	98,24	99,64	93,46	58.96	**17,25**
NAWA Region	74,46	48,58	39,92	49,98	86,33	83,29	**05,15**
LMI	46,34	89,54	85,24	82,29	88,59	95,89	**57,21**
Algeria score	42,58	97,67	85,92	94,25	99,77	6,39	**5,52**

Source: prepared by the researchers depending on GII 2023 -WIPO [Free Report]

Results & Discussion:

As can be discussed from the above, Algeria's rating in the GII 2023 is below the desired level. Some sub-indices, such as institutions (97), infrastructure (102), creative outputs (107), and human capital and scientific research (113), show encouraging levels. Indicators such as market sophistication, business sophistication, and knowledge and technology output continue to hinder Algeria's progress in its ranking for the index innovation. Yet, it is remarkably that in its 16th edition, the Global Innovation Index (GII) 2023, themed *"Innovation in the face of uncertainty"*, have shown that bridging the knowledge gap is very possible for many countries and societies that are considered weak and record low levels in the field of development in economy. There are many regional and worldwide peers that they have achieved economically qualitative leaps in recent year's innovation performance, such as: Iran, Mauritius, Philippines, Pakistan and Vietnam.

Algeria's challenges for ranking in Global Innovation Index (GII):

Algeria faced many challenges to track global innovation trends against a background of uncertainty caused by slow economic recovery from the COVID-19 pandemic, resulting in it being ranked 119th out of 132 economies according to GII 16th edition. Some of the key challenges include:

1- *Educational system* that is not adapted to the needs of the market: the Algerian education system does not fully meet the needs of the labor market, which leads to a shortage of the required skills and *brain drain* implication that leads to a slow economic growth, as many highly skilled young Algerians leave the country to seek better opportunities abroad;

2- *Infrastructure*: Algeria suffers from a *lack of digital infrastructure* as well as *complex bureaucracy* that leads Algerian companies to face complex bureaucracy from its starting or establishment. These two factors hinders the country's ability to innovate;
3- *Business environment:* the *lack of funding for startups* leads the latter to face difficulty in obtaining the funding necessary for their growth, and due to the *absence of innovation culture*, companies struggle to create a culture of innovation; and *International cooperation*: because of the *lack of international cooperation* in the field of innovation, Algeria international cooperation repeatedly fails in bringing competences in the field of innovation, which hinders the country's ability to innovate.

Solutions to Challenges:

- Increasing investment in education, research and development to enhance the country's innovation capacity;
- Reforming the education system to make it more relevant to the needs of the labor market;
- Improving digital infrastructure;
- Simplifying administrative procedures to facilitate the establishment and expansion of companies;
- Creating a favorable business environment conducive to innovation; and
- Strengthening international cooperation in the field of innovation.

Indicator strengths and weaknesses in GII 2023:

The two table below gives an overview of the indicator strengths and weaknesses of Algeria in the GII 2023.

Algeria's main innovation strengths are:

a. Gross capital formation % GDP (11) ;
b. Graduates in science and engineering (19);
c. Domestic market scale, bn ppp (40);
d. Industrial designs by origin /bn (48);
e. High-tech imports % total trade (53);
f. Researchers ; FTE/mn.pp (56).

Table 04 : an overview of indicator strengths of Algeria in GII 2023

Indicator strengths	Gross capital formation % GDP	Graduates in science and engineering	Domestic market scale	Industrial designs by origin	High-tech imports % total trade	Researchers
Classification	11	19	40	48	53	**56**

Source: prepared by the researchers depending on GII 2023 -WIPO [Free Report]

Algeria's main innovation weaknesses are:

a. High-tech exports % total trade (131);

b. Regulatory quality (130);

c. Software spending %GDP (128);

d. Vc recipients deals/bu (101);

e. National feature films (79);

f. Market capitalization %GDP (78).

Table 05 : an overview of indicator strengths of Algeria in GII 2023

Indicator strengths	High-tech exports % total trade	Regulatory quality	Software spending %GDP	Vc recipients deals/bu	National feature films	Market capitalization %GDP
Classification	131	130	128	101	79	**78**

Source: prepared by the researchers depending on GII 2023 -WIPO [Free Report]

The Global Innovation Index (GII) 2023 data analysis demonstrates two important factors behind the low level of Algeria's ranking in the Index: (a) missing data from official authorities; and outdated data. These two factors are directly and negatively affects the classification results.

Table 06: list for 11 indicators out of 80 indicators that that are missing for Algeria

Data availability

The following tables list indicators that are either missing or outdated for Algeria.

> Algeria has missing data for eleven indicators and outdated data for nineteen indicators.

Missing data for Algeria

Code	Indicator name	Economy Year	Model Year	Source
1.3.2	Entrepreneurship policies and culture	n/a	2022	Global Entrepreneurship Monitor
2.1.1	Expenditure on education, % GDP	n/a	2021	UNESCO Institute for Statistics
2.1.2	Government funding/pupil, secondary, % GDP/cap	n/a	2019	UNESCO Institute for Statistics
2.1.3	School life expectancy, years	n/a	2020	UNESCO Institute for Statistics
2.1.5	Pupil-teacher ratio, secondary	n/a	2020	UNESCO Institute for Statistics
4.1.1	Finance for startups and scaleups	n/a	2022	Global Entrepreneurship Monitor
4.1.3	Loans from microfinance institutions, % GDP	n/a	2021	International Monetary Fund, Financial Access Survey (FAS)
4.2.2	Venture capital (VC) investors, deals/bn PPP$ GDP	n/a	2022	Refinitiv; International Monetary Fund
5.1.2	Firms offering formal training, %	n/a	2019	World Bank Enterprise Surveys
6.1.3	Utility models by origin/bn PPP$ GDP	n/a	2021	World Intellectual Property Organization; International Monetary Fund
7.1.1	Intangible asset intensity, top 15, %	n/a	2022	Brand Finance

Source: Global Innovation Index (GII) 2023 -WIPO [Free Report]

Table 07: list for 19 indicators out of 80 indicators that that are outdated for Algeria

> Outdated data for Algeria

Code	Indicator name	Economy Year	Model Year	Source
1.3.1	Policies for doing business	2019	2022	World Economic Forum, Executive Opinion Survey (EOS)
2.1.4	PISA scales in reading, maths and science	2015	2018	OECD, PISA
2.3.1	Researchers, FTE/mn pop.	2017	2021	UNESCO Institute for Statistics; Eurostat; OECD; RICYT
2.3.2	Gross expenditure on R&D, % GDP	2017	2021	UNESCO Institute for Statistics; Eurostat; OECD; RICYT

Global Innovation Index 2023

Code	Indicator name	Economy Year	Model Year	Source
3.2.1	Electricity output, GWh/mn pop.	2020	2021	International Energy Agency
4.2.1	Market capitalization, % GDP	2018	2020	World Federation of Exchanges; World Bank
4.3.2	Domestic industry diversification	2015	2020	United Nations Industrial Development Organization
5.1.1	Knowledge-intensive employment, %	2017	2022	International Labour Organization
5.1.3	GERD performed by business, % GDP	2017	2021	UNESCO Institute for Statistics; Eurostat; OECD; RICYT
5.1.4	GERD financed by business, %	2017	2020	UNESCO Institute for Statistics; Eurostat; OECD; RICYT
5.1.5	Females employed w/advanced degrees, %	2017	2022	International Labour Organization
5.2.1	University-industry R&D collaboration	2019	2022	World Economic Forum, Executive Opinion Survey (EOS)
5.2.2	State of cluster development	2019	2022	World Economic Forum, Executive Opinion Survey (EOS)
5.2.3	GERD financed by abroad, % GDP	2017	2020	UNESCO Institute for Statistics; Eurostat; OECD; RICYT
5.3.2	High-tech imports, % total trade	2017	2021	United Nations Comtrade Database; World Trade Organization and United Nations Conference on Trade and Development
5.3.5	Research talent, % in businesses	2017	2021	UNESCO Institute for Statistics; Eurostat; OECD; RICYT
6.2.4	High-tech manufacturing, %	2015	2020	United Nations Industrial Development Organization
6.3.3	High-tech exports, % total trade	2017	2021	United Nations Comtrade Database; World Trade Organization and United Nations Conference on Trade and Development; Trade Data Monitor.
7.2.4	Creative goods exports, % total trade	2017	2021	United Nations Comtrade Database; World Trade Organization and United Nations Conference on Trade and Development

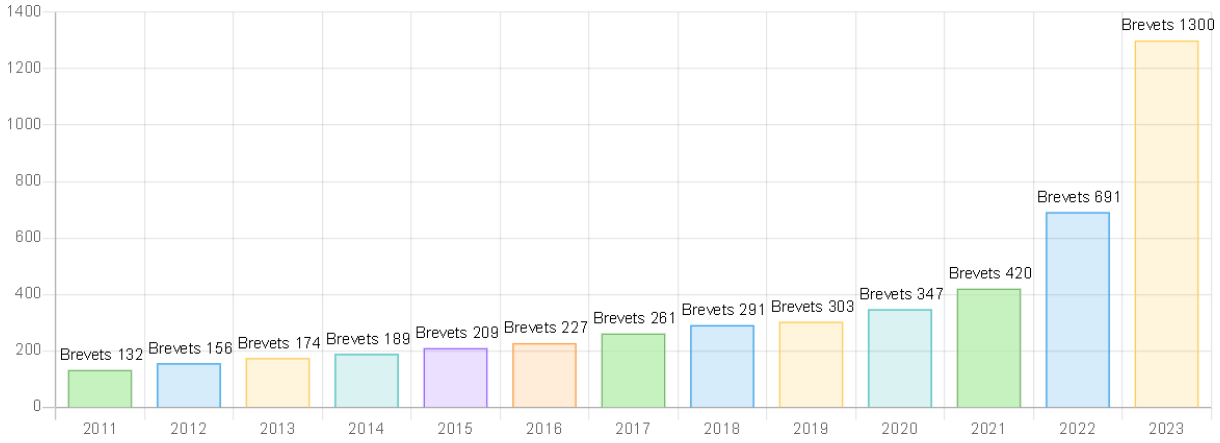
Source: Global Innovation Index (GII) 2023 -WIPO [Free Report]

The GII 2023 results analysis in light of Algerian official statistics:

Reading the 16th edition GII scale results carefully allows the researcher to logically analyze the indices one by one, given that the 7- GII pillars comprises around 80 indicators through which we can measure the innovation performance result to be aggregated until they form a country's position in one of the GII pillars. The official statistics of the Ministry of Higher Education and Scientific Research reveals that the strengths achieved by Algeria did not come out of nowhere, notwithstanding the fact that are the result of a continuous policy and a comprehensive strategy adopted by the Ministry within the recent years, including the valorization of human capital and scientific research and knowledge & technology outputs, focusing on three major areas (food security, energy security, health and the citizen) for realizing National research projects, in addition to encouraging startups and patents.

The following table shows the results of new trend against a background of uncertainty with double patents during the last three years, from 347 patents in 2020 to 1,300 patents in 2023, which equals the same as four times. This explains the results in both strengths: Gross capital formation (GDP - 11%) and graduates in science and engineering (19%), besides other strengths.

Fig 01: shows patents (Brevets) within the previous 13 years



Source: Ministry of Higher Education and Scientific Research official website <dgrsdt.dz>

Also, table 08 shows the size of investment in research institutions that have been completed, including research structures and business incubators directed to entrepreneurs and startups, research centers, technological and experimental stations, and laboratories equipped to conduct experiments and conduct research work directed to students and researchers alike.

Table 08: size of investment in scientific and research institutions

Institutions and Infrastructure for Research and Innovation	Research structures	Business incubator	Technological platform	Research unit	Research center	Thematic agency	Experimental station	Equipped laboratory
Number	04	96	21	47	30	03	31	**1801**

Source: prepared by the researchers depending on MESRS Official Data <dgrsdt.dz>

Addedly, table 09 uncovers the valuable efforts that were provided by the government to give a new breath to the scientific research by valorizing its outputs using the research programs, whether national or international, and putting them in the service of economy and society.

Table 09: national and international research programs data

Research Projects	Implemented National Research Programs	Under-implementation National Research Programs	Research projects with socioeconomic impact	International Research projects	Mixed Research Team	Common Research Interests
Number	2731	203	421	/// (Prima & Erasmus…….)	69	**74**

Source: prepared by the researchers depending on MESRS Official Data <dgrsdt.dz>

Conclusion:

Algeria has great potential to improve its ranking in WIPO Global Innovation Index (GII). Following a set of measures and policies in which weaknesses were spotted, Algeria would become a leading country by driving the national innovation potential at a higher level within the geographic region of interest, where the possibility of bridging the knowledge gap is very likely in comparison with other regional and worldwide economic peers that have moved up significantly in the innovation index ranking in recent years, such as; Iran, Pakistan, Philippines, Vietnam, Mauritius and other countries that their economic characteristics match with those of the Algerian economy.

Algeria would improve its ranking in the WIPO GII, by working on the following indicators:

a. *Investing in infrastructure:* improving roads, transportation, electricity, and Internet;
b. *Strengthening human capital and research:* improving the quality of education, increasing the number of researchers, and supporting research institutions;
c. *Encouraging knowledge and technology production:* supporting emerging companies, establishing innovation centers, and encouraging technology transfer; and
d. *Improving creative productions:* supporting artists and creators, creating educational programs in the field of creativity, and organizing cultural events.

The WIPO GII score report should not only be considered as an instrument to present data but to encourage developing and developed economies to carefully examine data and explore their strengths and weaknesses to enhance their knowledge-based economy rather than merely seeking to move up the WIPO GII ranking. Further research in this context would expectantly be of great interest.

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References:

1. Robert Kreitner,0515, management Boton, Houghton Mifflin co.
2. Maureen Mckelvey, 4111, Evolutionary Innovation, oxford university press.
3. Efendi, 2022
4. Tiina, Apilo, 4101, A model for corporate renewal requirement for innovation management, university of technology, Lappeenranta, finland , on the 09th
5. Menad, innovation and development durable; Egypt 2021
6. Bouqmoum, 2018
7. JOHNSON , INSEAD , WIPO , The Global Innovation Index 4102 , The Human Factor in Innovation .
8. Narayan, paresh, Smyth, Russel, 4111, Energy con sumption and real GDP in G6 countries: New Eveidence from panel conitegration with structural breaks economic No.21
9. Abdulwahab, Boudgu, 2021, The Role of Innovation in Supporting the Competitive Advantage of Economic Institutions: A Case Study of Algerian Mobile Telecommunications, University of Mentouri, Algeria.
10. Najm, Aboud, 2003, Innovation Management: Concepts, Characteristics, and Modern Experiences, Wael Publishing and Distribution House, Amman.
11. Jaldah, Butri and Aboudi Zaid, 2006, Management of Creativity and Innovation, Dar Kunooz Al Ma'arifa, Amman, Jordan.
12. https://www.msn.com
13. https://www.massarate.ma
14. www.globalinnovationindx.org
15. https://data.albankaldawli.or
16. www.wipo.org
17. www.dgrstd.dz
18. www.mesrs.dz