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By Amina Zerdoudi & Sabri Mekimah

University of 20 Août 1955 SKIKDA

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Keywords: *knowledge economy, competitiveness, KEI index, GCI index, algeria.*

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The Development of Knowledge based Economy and its Impact on Competitiveness in Algeria and Some Comparatives Countries

Amina Zerdoudi [α] & Sabri Mekimah [σ]

Abstract- The present study aims to evaluate the position of Algeria in the knowledge economy, which is seen as an inevitability to strengthen competitiveness and achieve economic development. In this context, we try through this study firstly to know the impact of the knowledge economy on competitiveness, applying the Knowledge-Based Economy Indicator (KEI index) according to the World Bank methodology, and the competitiveness indicator according to the World Economic Forum report (GCI index), which will allow us to compare Algeria with indicator countries. The study is realized by using descriptive statistics, correlation, regression and comparative analysis. The study is composed of the following parts: analysis of the competitiveness of Algeria and comparative countries according to the GCI and the KEI, as well as according to the pillars within the KEI, examination of interdependence GCI and KEI and an examination of the impact of the pillar within the KEI on GCI in Algeria and comparative countries. Research results indicate that there is a medium positive correlation between the GCI and KEI. The results of this study provide recommendations to the policy makers in Algeria and comparative countries.

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I. Introduction

Global competitiveness has been one of the goals of countries worldwide in the last few years, especially after the financial crisis emphasized the need for new strategies, innovations and dynamics in the economic and business environment.

The theme of knowledge-based economy (KBE) has become increasingly important, being seen as a source of economic growth and competitiveness in all economic sectors. As a consequence of this development, the author provides evidence that scholars and commentators have pleaded in favor of using modern resources that enrich knowledge-based-economies, such as investments in IT&C, high-technology industries, and highly skilled workers.

These factors are perceived as fundamental factors of KBE. In this economy, a new form of organizations and work governs the world of business, demanding the rapid development of skills, solid knowledge and greater responsibility. Contemporary society thus becomes a learning society, adapting to the new, and in this context educational systems must aim at the formation of people able to contribute to the development of their own competencies, to integrate fully in the socio-cultural context.

The term "*knowledge-based economy*" results from a fuller recognition of the role of knowledge and technology in economic growth. The OECD economies are more strongly dependent on the production, distribution and use of knowledge than ever before. Output and employment are expanding fastest in high-technology industries, such as computers, electronics and aerospace. In the past decade, the high-technology share of OECD manufacturing production and exports has more than doubled, to reach 20-25 per cent. Knowledge-intensive service sectors, such as education, communications and information, are growing even faster. Indeed, it is estimated that more than 50 per cent of Gross Domestic Product (GDP) in the major OECD economies is now knowledge-based (OECD, 1996).

Although the remarkable advancement of the developed countries, developing countries, in particularly Algeria progress slowly to absorb knowledge and catch up the developed countries.

According to these facts we have chosen the following theme: "*The impact of the development of knowledge based economy on competitiveness in Algeria»,* this led us to the following main question: *How does the development of the knowledge based economy in Algeria affect the competitiveness of the Algerian economy?.*

The aim of this study is to examine the interdependence between GCI and KEI, as well as, between GCI and pillars within KEI (Economic Incentive & Institutional Regime, Innovation, Education, and ICT). The aim of this research is determining the impact of the pillars within KEI on value of GCI in Algeria and comparatives countries.

In accordance with the purpose of this study, the authors tested the following hypotheses:

Hypothesis 1: Algeria and the comparatives countries are heterogeneous in terms of performance (the score pillars of the KEI index determine the overall level

Author α: Doctor in International Economics, Member of the Maghtech Network, University of 20 Août 1955 SKIKDA, Algeria.
Author σ: Doctor in Management, Director of Research Laboratory ECOFIMA University of 20 Août 1955 SKIKDA, Algeria.
e-mail: sab88mek@gmail.com

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achieved by the development of the knowledge economy).

Hypothesis 2: There is a correlation between the GCI and the level of knowledge economy development in Algeria and the comparatives countries.

Hypothesis 3: The pillar within KEI influence morally and positively the GCI in Algeria and the comparatives countries. Which in turn was divided into sub-hypotheses:

First sub-Hypothesis: The pillar of economic incentive and institutional regime affects morally and positively on the GCI in Algeria and comparatives countries.

Second sub-Hypothesis: The pillar of Innovation and Research and Development affects morally and positively on the GCI in Algeria and comparatives countries.

Third sub-Hypothesis: The pillar of Education and Training affects morally and positively on the GCI in Algeria and comparatives countries.

Fourth sub-Hypothesis: The pillar of ICT affects morally and positively on the GCI index in Algeria and comparatives countries.

The study is structured from the following parts: First, we specify the Conceptual Framework of knowledge economy and competitiveness. The research methodology is presented in the second part. Third part of the study refers to the research results and discussions. For the purpose of testing research hypotheses. The results of this study provide recommendations to the policy makers in Algeria and comparatives countries and point out the necessity of improving the performance of all four pillars of the knowledge economy.

II. Conceptual Framework

a) Development of knowledge based economy

Knowledge and competitiveness represent two key factors for enhancing long-term economic development, innovation and sustainability.

In the knowledge economy, intangible assets, such as knowledge and information management, become the new core of competencies. We are in a world where we deal with "cognitive domains", where ideas are worth billions, while products cost less.

According to Hoppe's view, knowledge accumulation is an old and endless evolving learning process that individuals and societies have been contributing to. This knowledge accumulation starts with individuals who make up the building blocks of societies by developing different skills through the accumulation and use of knowledge. Only individuals can know and what they know depends on their perceptions, experience, memory and inference. Knowledge is thus shaped, refined and continually molded by the activities that individuals engage in during their lifetime, boosted by the curiosity and uncertainty that nurture the continuous knowledge creation process via everyday experience and interaction with others (Hoppe, 1997).

Launched towards the end of the 1950s and early 1960s due to researches of Drucker (1959/1994) and Machlup (1962), the concept focused mainly on the emergence of innovative industries as well as on the impact they had on the economic changes. However, the newly coined term proved to be difficult from the point of view of finding a universally accepted definition (Bontis, 2004; Wood, 2003). When referring to a knowledge economy, Druker (1998) depicts it as the appearance of knowledge management and knowledge workers, to the detriment of the manual workers, or another way round, the transition from 'brawn to brain'. Several economic forums and institutions, and not only, manifested their interest in defining KE as well as trends that this economy is characterized by.

The consensus (OECD, 1996; APEC, 2003; Bontis, 2002; Drucker, 1999; Houghton and Sheehan, 2000; Powell and Snellman 2004) seems to concentrate on broad trends and factors that have caused this knowledge economy upsurge:

- Technological advancement particularly in communication, computing, transportation and information exchange;
- Globalization of the world economy which requires countries and firms alike to integrate in the world economy and become more innovative and quicken the process of adaptability;
- The increasing importance of specialized knowledge as a tool in coping with the new trend of globalization;
- The shift in the awareness that knowledge has become a distinct factor of production more than any other traditional factors of production;
- The creation of potential solutions to sustainable economic growth as well as new jobs generation.

The knowledge-based economy is defined by representatives of the Organization for Economic Cooperation and Development (OECD, 1996, p.7) as "economies which are directly based on the production, distribution, and use of knowledge and information". In the knowledge economy, people who possess, use and transfer knowledge are important. That is why people, knowledge, and technology need to be concerted and synergized to facilitate the enhancement of benefit at the level of the organization, local community and/or macroeconomic level. Knowledge based economies are "economies in which the proportion of knowledge-intensive jobs are high, the economic weight of information sectors is a determining factor, and the share of intangible capital is greater than that of tangible capital in the overall stock of real capital" (Foray, 2004, p. ix).

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The UN experts add other features to the previously mentioned definitions: competitiveness and economic growth (Huggins, Izushi, Prokop & Thompson, 2014). Thus, the knowledge-based economy is an economy in which knowledge is created, distributed and used to ensure economic growth and ensure the international competitiveness of a country. At the same time, knowledge has beneficial effects spread across all sectors and economic processes. This definition is completed by the Asia-Pacific Economic Cooperation, which highlights the importance of the knowledge-based economy, arguing that the production, distribution, and use of knowledge are the engine of development and profit-making and the premise of employment in all areas of trade (APEC, 2000). APEC (2000) considers as essential to the knowledge-based economy - the need to be competitive in a world full of both economic and political changes. The knowledge-based economy promotes innovation, initiative, entrepreneurship, and dynamism, being the economy whose one production factor is knowledge (Skrodzka, 2016).

Given the latest trends in the global development of the emerging countries of the market economy, the most important is the focus on building a knowledge-based economy. This means that the main priority should be to develop human skills, focusing on: education, science, and vocational training. Only in this way is it possible to integrate into the rapid processes of globalization.

The knowledge-based economy has transformed the business world by reevaluating the role of innovation as a core process of production, and as an important factor in business success.

The theories defining competitiveness have been derived mostly throughout time from Adam Smith's international trade theories, being adapted as other influence factors arose over time and impacted competitiveness on company, regional or country levels. The OECD, namely "the ability of companies, industries, regions, nations or supranational regions to generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels on a sustainable basis", provided one general definition of competitiveness. In this type of definition, competitiveness is described mainly with regard to financial outcomes.

b) Measuring the international competitiveness

There are different models to analyze competitiveness within the countries. The first model is the one proposed by the German Institute for Development, which is known as "Systemic Competitiveness" and is founded in four levels: meta-economic, macroeconomic, miso-economic, and Microeconomic. In this model, higher education and all the government levels are part of the miso-economic level.

The Institute for Management Development (IMD) proposes a second model. This institute sponsors the World Competitiveness Center that presents an annual ranking of competitiveness, and in 2015 ranked sixty-one countries. Competitiveness is analyzed considering four primary factors: Economic performance, Government efficiency, Business efficiency, and Infrastructure. Each of those factors is divided into five sub-factors. The twenty sub-factors are assessed considering 300 criteria. Education is the fifth sub-factor within the factor of infrastructure, which is evaluated using 18 criteria. Considering Porter's theories and his Single Diamond (SD) model, in 2013 Cho and Moon developed other models with a higher number of variables, such as the Generalized Double Diamond (SD), the Nine Factors Model (NFM) and the Dual Double Diamond (DDD).

Introducing an international variable in the existing domestic model SD creates the GDD model. The NFM is formed by introducing a diamond of human factors to the existing diamond of physical factors. The integration of these two extensions and the incorporation of international human factors into the single framework produce the DDD model (Cho and Moon, 2013, p.172).

Cho and Moon designed four rankings considering sixty-six countries; the first one belongs to the simple model of Porter SD, the second one to the NFM, the third one to the GDD and the last to the DDD. Comparing the last three rankings to the SD, we found out that by introducing the variable of human capital, countries moved 3.27 positions on average. Likewise when the variable 'international' is considered (3.4 positions). Although, the greater variation in the positions happened when we introduced the variable 'international human capital' (5 positions on average). This means that the introduction of this variable in the DDD ranking, completely modified the original SD model by Porter, which agrees with Lane's opinion (2012) who states that Porter did not consider the institutions that form human capital in his analysis of competitiveness.

The WEF defines competitiveness "as the set of institutions, policies and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the country can earn." (Sala-i-Martin, et. al, 2015, p. 4)

WEF assess competitiveness within the countries through the Global Competitiveness Index (GCI), including 144 indicators grouped in twelve pillars. The interest of this work is focused on pillar five of higher education and training.

The GCI includes statistical data from internationally recognized agencies: notably the

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International Monetary Fund (IMF), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the World Health Organization (WHO). It also includes data from the World Economic Forum's Annual Executive Opinion Survey to capture concepts that require a more qualitative assessment (Sala-i-Martin, et al, 2015, p. 5). One hundred sixty partner institutes from all over the world participate in the administration of the surveys and interviewed business executives.

In 2015, WEF ranked the competitiveness of 140 countries. They are ranked from 1 to 140 with 1 being the highest rank.

Moreover, there has been a considerable increase in studies regarding economics of education, economics of innovation and in general economics of knowledge and information. That is because these variables are strategic elements for promoting competitiveness in the countries.

The concept of competitiveness of the countries was introduced by Porter in 1990, with his book The competitive advantage of nations where he states that economic competitiveness of the nations in the 21st century would be created and not inherited, and he was right about it, because as Lane (2012) properly stated the pillars of competitiveness had been significantly transformed. Lane says that, twenty years ago the debate regarding the role that universities had in the increasing of competitiveness was minimum.

Porter focused his analysis almost exclusively on the firms and their role in the creation of factors that lead the economy and directed the activities within the universities, which were looking to satisfy the necessities of the industry. Comparative studies in higher education emerged in this context.

Globalization processes combined with the global development model that is sustained by knowledge economy has resulted in the phenomenon of the pursuing global competitiveness, influencing policies and higher education decisions and actions, which has also entered in a process of competitiveness in the global context. This is confirmed by Portnoi, Bagley and Rust (2010), who points out that competition among universities takes different forms, it can occur in the institutional, local, regional, national and global levels.

III. Research Methodology

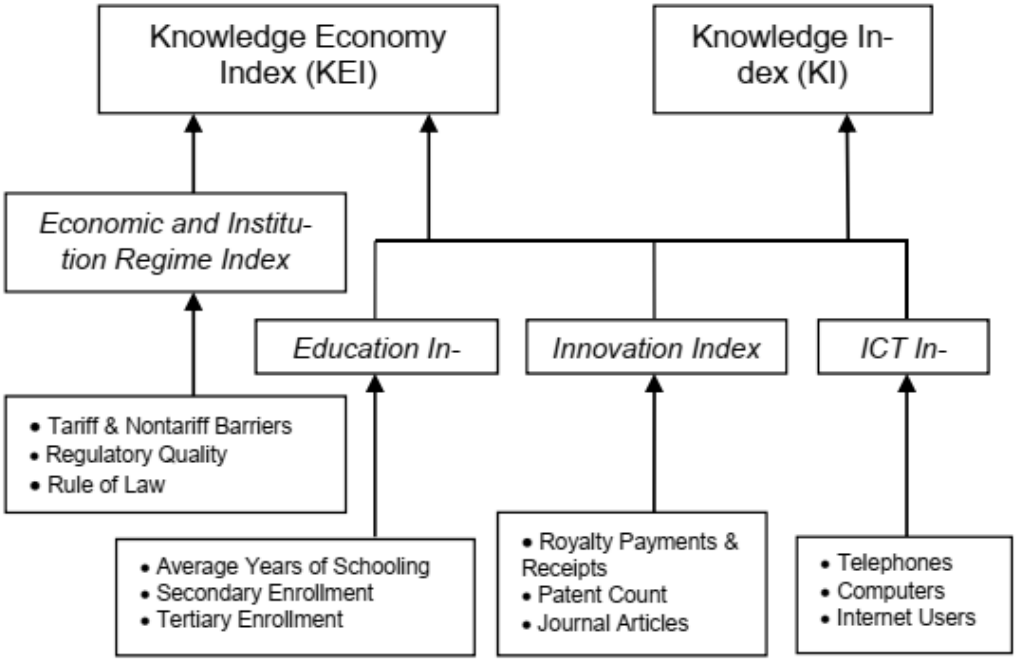
For the empirical analysis, we selected one dependent variable, the KEI and independent variable the GCI, Information base for this research consists of the information contained in The Global Competitiveness Report 2012-2013 and the data of the World Bank – Knowledge Economy Index (KEI) for 2012.

The methodology for measuring national and global competitiveness of the World Economic Forum (WEF) systematizes the key factors into 12 groups of factors in order to quantify the level of competitiveness of the national economy and rankings.

These so-called competitiveness pillars are: basic factors (institutions, infrastructure, macroeconomic stability, health and primary education), the efficiency factors (higher education, goods market efficiency, labor markets efficiency, financial market development, technological competence/capacity, market size) and innovation factors (business/business process sophistication, innovation). Composite the Global Competitiveness Index (GCI) is a result of measuring many factors and variables.

The growing need to measure the KE forced International Institutions to develop instruments and programs for measuring it in every country/region and for comparing countries at the international level (Debnath, 2015). In this respect, several KE Assessment Methodologies were developed, the most important and highly used is the one created and applied by the World Bank. Currently, this assessment is made up of 109 structural and qualitative variables, differentiated for 146 countries, the final goal is the measurement of their performance in direct accordance with the four KE pillars (World Bank, 2012):

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Source: The World Bank (WB), Knowledge Economy Index (KEI) 2012 Rankings, http://siteresources.worldbank.org/INTUNIKAM/Resources/2012.pdf

Figure 1: KEI and KI indexes

The results from the analysis of the four pillars are grouped in two indexes: Knowledge Index and the Knowledge Economy Index, according to Figure 1.

The indices have values ranging from 0 to 10, the highest rank representing the highest KE as well (Chen & Dahlman, 2005; Sundać & Krmpotić, 2011).

IV. Research Results and Discussions

In the purpose of realizing the given task and testing hypotheses, the paper is structured in the following sections:

- Analysis of Algeria's competitiveness according to GCI and KEI;
- Analysis of pillar within KEI in Algeria;
- Examining the correlation between GCI and KEI in Algeria;
- Analysis of the influence of pillar within KEI on GCI in Algeria.

a) Analysis Algeria's competitiveness according to GCI and KEI

Analysis Algeria's competitiveness is based on data about rank and score of GCI, presented by the World Economic Forum and data about rank and score of KEI, presented by the World Bank. Table 1 shows the position of Algeria and some Arab and emerging countries according to rank and score of GCI for 2012, as well as the average score.

Table 1: Rank and score of GCI for Algeria and some Arab and emerging countries (2012).

GCI index		
Countries	Score	Rank/144
Algeria	3.72	110
Morocco	4.15	70
Egypt	3.73	107
Saudi Arabia	5.19	18
Jordan	4.23	64
Bahrain	4.63	35
Brazil	4.40	48
India	4.32	59
China	4.83	29
South Africa	4.37	52
Average	4.36	-

Source: The Word Economic Forum (WEF): The Global Competitiveness Reports 2012 - 2013, http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2012-13.pdf

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Based on the table's data, we find the highest score of the GCI index for the year 2012 recorded to Saudi Arabia with a score of 5.19, where it represents the highest score among the Arab countries, followed by China as an emerging country with a score of 4.83.

Also, based on the score of the GCI indicators, five countries managed to exceed the global average (4.36) which is Saudi Arabia, China, Bahrain, Brazil and South Africa, while the rest of the countries selected for the study were not able to exceed the global average, and Algeria came in the last ranking with a score of 3.72.

As for Algeria is ranking among the 144 countries mentioned in the report of the Global Competitiveness Index for the year 2012, it ranked 110 late.

Algeria has made significant strides in the past five years, which enabled it to score better results in the recent report of the World Economic Forum on the Global Competitiveness Index, with a score of 4.07 and ranked 87th out of 138 countries mentioned in the report.

Table 2 shows the position of Algeria and some Arab and emerging countries according to rank and score of KEI. The World Bank analyzed and ranked total 144 countries in 2012.

Table 2: Rank and score of KEI for Algeria and some Arab and emerging countries (2012).

KEI index		
Countries	Score	Rank/144
Algeria	3.79	96
Morocco	3.61	102
Egypt	3.78	97
Saudi Arabia	5.96	50
Jordan	4.95	75
Bahrain	6.90	43
Brazil	5.58	60
India	3.06	110
China	4.37	84
South Africa	5.21	67
Average	5.12	-

Source: The World Bank (WB), Knowledge Economy Index (KEI) 2012 Rankings, http://siteresources.worldbank.org/INTUNIKAM/Resources/2012.pdf

As the report of the World Bank contains a total of 144 countries in 2012, Bahrain obtained the highest score for the KEI index for the year 2012 with a score of 6.90 and ranked 43 globally (out of 144 countries), followed by Saudi Arabia with a score of 5.96 (ranked 50), for Algeria it got a score of 3.79 (Ranked 96). and therefore it is lower than the global average (5.12) for the total countries selected for the study. while the worst results were returned to Morocco with a score of 3.61 (ranked 102) and India with an index score of 3.06 (ranked 110). Countries with scores below the world average: China, Algeria, Egypt, Morocco and India.

Table 3 presents the results of descriptive statistics according to score of GCI and KEI in Algeria and some Arab and emerging countries in 2012.

Table 3: Results of descriptive statistics for Algeria and some Arab and emerging countries according to score of GCI and KEI in 2012.

Indicators	N	Min	Max	Mean	Std Deviation	Variation Coefficient
GCI	10	3.72	5.19	4.36	0.45	10.41
KEI	10	3.06	6.90	4.72	1.21	23.27

Source: Author calculation

From the previous table, the lowest score for the GCI index was 3.72, the highest score at 5.19, and the average scores were 4.36 with a standard deviation of 0.45, for the KEI index the lowest score was 3.06 and the highest score was 6.90, while the average scores were estimated at 4.72 and a deviation Standard 1.21, and therefore there is variation and heterogeneity between countries, and this is confirmed by the contrast rate for both the GCI index and the KEI index.

b) Analysis of the pillar within KEI in Algeria and comparative countries.

In order to assess the achievements of Algeria and comparative countries in each pillar of the knowledge economy, the scores of pillars within KEI for 2012 are presented in Table 4. In order to understand the relative positions of countries according to each pillar, their average value is given in the following table.

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Table 4: Score and rank of pillars within KEI for Algeria and comparative countries (2012).

Countries	Economic Incentive And Institutional Regime		Innovation		Education		ICT	
	SCORE*	Rank**	SCORE	Rank	SCORE	Rank	SCORE	Rank
Algeria	2.33	10	3.54	10	5.27	5	4.04	5
Morocco	4.66	5	3.67	9	2.07	10	4.02	6
Egypt	4.50	6	4.11	7	3.37	8	3.12	9
Saudi Arabia	5.68	2	4.14	6	5.65	2	8.37	2
Jordan	5.65	3	4.05	8	5.55	4	4.54	4
Bahrain	6.69	1	4.61	4	6.78	1	9.54	1
Brazil	4.17	7	6.31	2	5.61	3	6.24	3
India	3.57	9	4.50	5	2.26	9	1.90	10
China	3.79	8	5.99	3	3.93	7	3.79	7
South Africa	5.49	4	6.89	1	4.87	6	3.58	8
Average	4.75	-	4.78	-	4.53	-	4.91	-

Source: The World Bank (WB), http://info.worldbank.org/etools/kam2/KAM_page5.asp

Upon observing the results of the countries, we found that the information and communication technology (ICT) column recorded the highest rate with a score of 4.91, occupying the pillar of innovation and research and development with the second position at 4.78, followed by the pillar of economic incentives and the institutional regime at 4.75, and finally the pillar of education and training at 4.53.

Analysis of the results of Algeria and comparative countries in each pillar:

With regard to the pillar of the economic incentive and institutional regime , we noted that most of the selected countries have rates below the global average for the pillar of the economic incentive and institutional regime incentives (Morocco, Egypt, Brazil, India, China), including Algeria. While the highest rate was recorded in Bahrain with a score of 6.69 Also, Saudi Arabia, Jordan, and South Africa were higher than the global average.

As for the pillar of innovation and research and development, the highest rate was recorded in South Africa with a score of 6.89, followed by Brazil and China, while for the rest of the countries it was not able to exceed the global average (4.78), and the lowest level was recorded in Algeria with a score of 3.54.

As for the results of the pillar education and training, Algeria managed to achieve good results 5.27, registering a higher rate than the global average (4.53), as well as returning the highest score to Bahrain by 6.78, and Saudi Arabia, Jordan, Brazil and South Africa achieved a greater rate than the global average, Morocco's lowest rate was 2.07.

As for the results of the pillar of ICT, Algeria's results were below average of 4.04 and ranked 5th among the selected sample, and this did not prevent Algeria from achieving better results than those recorded in Morocco, Egypt, India, China and South Africa. The best results were recorded in Bahrain at a rate of 9.54, followed by Saudi Arabia, Brazil and Jordan.

From the foregoing and the results achieved in Algeria and the rest of the countries in the main pillars of the KEI index, it is clear that the scores achieved by Algeria are not homogeneous, which confirms the validity of the first sub-hypothesis.

c) *Examining the correlation between GCI and KEI in Algeria and comparative countries.*

In order to examine the interdependence between competitiveness (measured by GCI) and knowledge economy development (measured by KEI) in Algeria and comparative countries.

The method: Person Correlation

Table 5: Correlation coefficient between score of GCI and score of KEI in Algeria and comparative countries (2012).

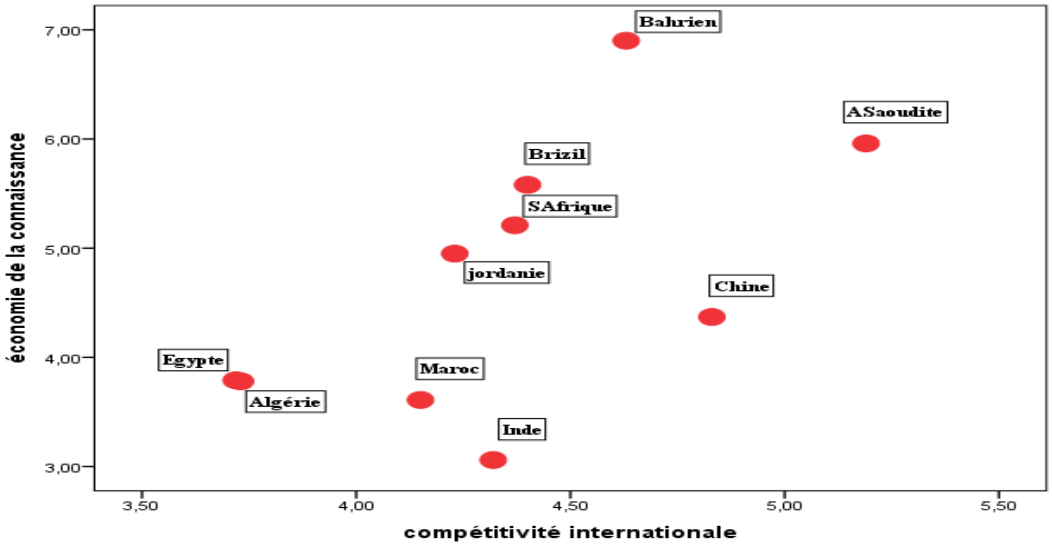
Correlation			
GCI	Pearson correlation	1	,597
	Sig.		,069
	N	10	10
KEI	Pearson correlation	,597	1
	Sig.	,069	
	N	10	10

Source: Author calculation based on SPSS.

Determined value of the correlation coefficient between GCI and KEI of 0.59 indicates a medium positive correlation. In this way, it can be concluded that the competitiveness of Algeria and comparative countries is based on knowledge, as a factor that in modern economy offers significant opportunities for competitiveness enhancement. Accordingly, these

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countries still have many stages to integrate into the knowledge economy.



Source: Author calculation based on SPSS.

Figure 2: The correlation coefficient (medium positive correlation) between GCI and KEI in Algeria and comparative countries.

Therefore, it can be confirmed the second hypothesis that there is a correlation between the international competitiveness index GCI and the level of development of the knowledge economy in Algeria and comparative countries.

In order to study the correlation between GCI and pillars within KEI we applied "a correlation analysis", the table 6 analyze the correlation between GCI and pillars within KEI in Algeria and comparative countries (2012).

Table 6: Correlation coefficient between GCI and KEI with pillar within KEI in Algeria and comparative countries (2012).

	GCI	KEI	REG	EDU	INNO	ICT
GCI	1	,597	,479	,338	,318	,577
SIG		,069	,161	,339	,371	,081
N	10	10	10	10	10	10
KEI	,597	1	,748*	,317	,863**	,902**
SIG	,069		,013	,372	,001	,000
N	10	10	10	10	10	10
REG	,479	,748*	1	,114	,444	,633*
SIG	,161	,013		,755	,199	,050
N	10	10	10	10	10	10
EDU	,318	,863**	,444	,182	1	,767**
SIG	,371	,001	,199	,615		,010
N	10	10	10	10	10	10
INNO	,338	,317	,114	1	,182	-,029
SIG	,339	,372	,755		,615	,936
N	10	10	10	10	10	10
ICT	,577	,902**	,633*	-,029	,767**	1
SIG	,081	,000	,050	,936	,010	
N	10	10	10	10	10	10

Source: Author calculation based on SPSS.

To analyze the correlation between the GCI index and the pillars within KEI index we found that there was a weak direct correlation with a score of (0.48) between the pillar of economic incentive and institutional regime and the GCI index. Therefore Algeria and the comparative countries do not rely on the pillar of economic incentive and institutional regime significantly to enhance their competitiveness.

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The correlation between the GCI index and the pillar of innovation and research and development was also weakly correlated with a score of (0.34). Therefore, Algeria and the comparative countries also do not rely on the pillar of innovation and research and development with a large degree to enhance competitiveness.

The correlation between the GCI index and the pillar of education and training was also weakly correlated with a score of (0.32). Therefore, Algeria and the comparative countries also do not rely heavily on the pillar of education and training to enhance competitiveness.

While the correlation between the GCI index and the pillar of ICT it was Intermediate correlation of (0.57), accordingly, it can be said that Algeria and the comparative countries rely moderately on the pillar of ICT to improve their competitiveness.

d) Analysis of influence of pillars within KEI on GCI in Algeria and comparative countries.

To study the validity of the third hypothesis "Algeria's integration into the knowledge economy has a major impact on competitiveness", we will study the effect of each pillars within KEI.

i. *The effect of the pillar of economic incentive and institutional regime on the GCI*

First Sub-Hypothesis: The pillar of economic incentive and institutional regime effect significantly and positively on the GCI index in Algeria and comparative countries.

To identify the influence between the independent variable (GCI) and the dependent variable (economic incentives and institutional systems), and to test the model's ability to interpret, we used both of the correlation coefficient (R), the determining coefficient (R^2) and the modified determining coefficient (R^{-2}) As shown in Table 7.

Table 7: Regression form (sub-hypothesis 1)

R	R^2	R^{-2}	Sig
0.479	0.230	0.133	0.42248

Source: Author calculation based on SPSS.

The above table showed that the correlation coefficient is estimated at (0.48), which indicates the existence of a weak direct correlation between the independent variable and the dependent variable, as the value of the coefficient of determination (R2) (0.23), and this means that the independent variable explains 23% of the variance in The dependent variable. The remaining percentage is due to other factors not studied, and the hypothesis will be tested as well using the statistic T in the analysis as shown in the table.

Table 8: The regression coefficient according to T statistic (sub-hypothesis 1).

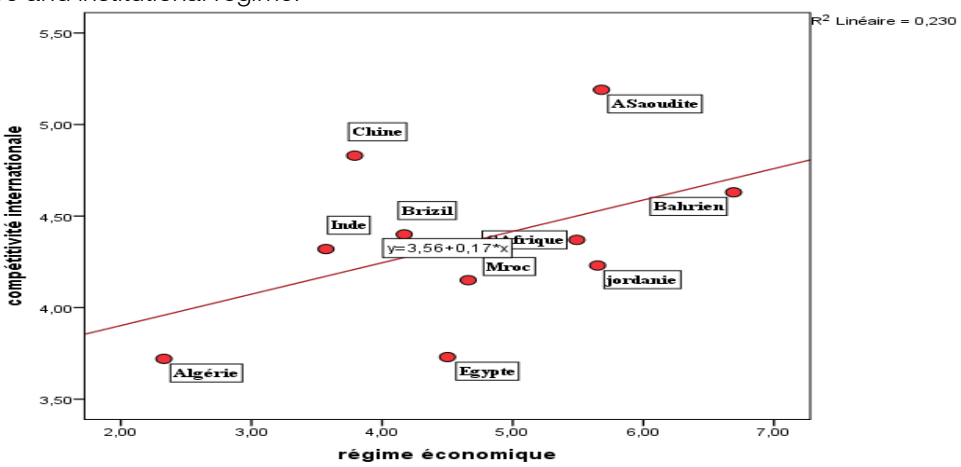
	B	Standard error	BETA	T	SIG
a	3.559	0.534		6.668	0.000
	0.171	0.111	0.479	1.544	0.161

Source: Author calculation based on SPSS.

According to the previous table, the simple linear regression equation can be extracted as follows:

GCI index = 3.56 + 0.17 (the pillar of economic incentive and institutional regime) + remaining

Figure 3 shows the simple linear regression equation model for the competitiveness index and the pillar of economic incentive and institutional regime.



Source: Author calculation based on SPSS.

Figure 3: The simple linear regression equation model for the competitiveness index and the pillar of economic incentive and institutional regime.

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From the above, it can be concluded that:

The value of T was 1.54 and the corresponding level of significance was 0.16, which is statistically insignificant, which means that there is no significant and positive effect of the pillar of economic incentive and institutional regime on the competitiveness index in Algeria and the comparative countries, at the level of significance of 5%. In fact, the hypothesis is refused: the pillar of economic incentive and institutional regime affects morally and positively on the GCI in Algeria and the comparative countries.

ii. *The effect of the pillar of innovation, research and development on the GCI*

Second Sub-Hypothesis: The pillar of innovation, research and development effect significantly and positively on the GCI index in Algeria and comparative countries.

To identify the influence between the independent variable (GCI) and the dependent variable (innovation, research and development), and to test the model's ability to interpret, we used both of the correlation coefficient (R), the determining coefficient (R^2) and the modified determining coefficient (R^{-2}) As shown in Table 9.

Table 9: Regression form (sub-hypothesis 2)

R	R^2	R^{-2}	Sig
0.338	0.114	0.004	0.45299

Source: Author calculation based on SPSS.

The above table showed that the correlation coefficient is estimated at (0.34), which indicates the existence of a weak direct correlation between the independent variable and the dependent variable, as the value of the coefficient of determination (R^2) (0.11), and this means that the independent variable explains 11% of the variance in The dependent variable. The remaining percentage is due to other factors not studied, and the hypothesis will be tested as well using the statistic T in the analysis as shown in the table.

Table 10: The regression coefficient according to T statistic (sub-hypothesis 2).

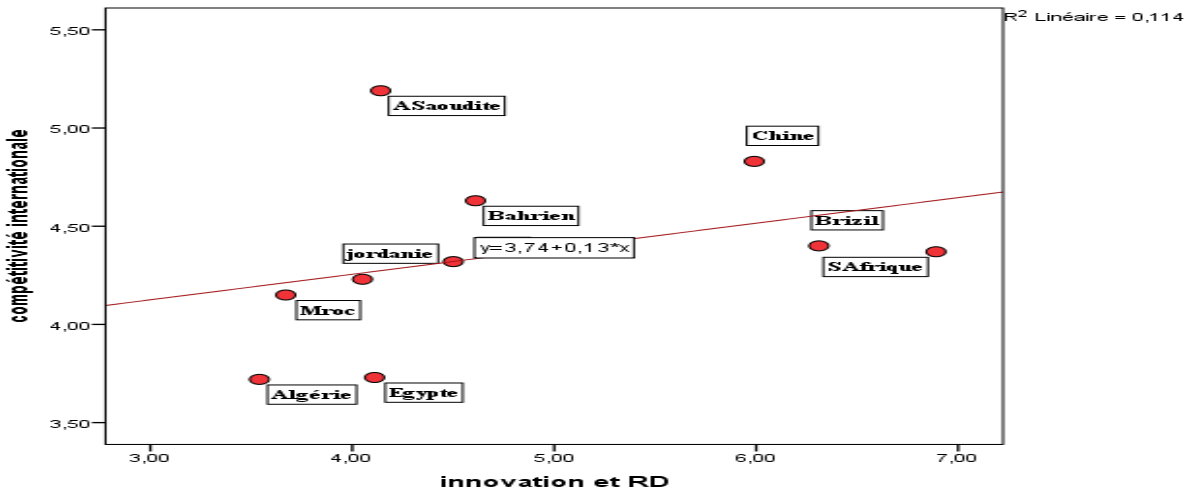
	B	Standard error	BETA	T	SIG
a	3.735	0.628		5.943	0.000
	0.130	0.128	0.338	1.016	0.339

Source: Author calculation based on SPSS.

According to the previous table, the simple linear regression equation can be extracted as follows:

GCI index = 3.56 + 0.17 (the pillar of innovation, research and development) + remaining

Figure 4 shows the simple linear regression equation model for the competitivité index and the pillar of innovation, research and development.



Source: Author calculation based on SPSS.

Figure 4: The simple linear regression equation model for the competitiveness index and the pillar of innovation, research and development.

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From the above, it can be concluded that:

The value of T was 1.02 and the corresponding level of significance was 0.34, which is statistically insignificant, which means that there is no significant and positive effect of the pillar of innovation and research and development on the competitiveness index in Algeria and the comparative countries, at the level of significance of 5%. In fact, the hypothesis is refused: the pillar of innovation and research and development regime affects morally and positively on the GCI in Algeria and the comparative countries.

iii. *The effect of the pillar of education and training on the GCI*

Third Sub-Hypothesis: The pillar of education and training effect significantly and positively on the GCI index in Algeria and comparative countries.

To identify the influence between the independent variable (GCI) and the dependent variable (education and formation), and to test the model's ability to interpret, we used both of the correlation coefficient (R), the determining coefficient (R^2) and the modified determining coefficient (R^{-2}) as shown in Table 11.

Table 11: Regression form (sub- hypothesis 3)

R	R^2	R^{-2}	Sig
0.318	0.101	-0.011	0.45637

Source: Author calculation based on SPSS.

The above table showed that the correlation coefficient is estimated at (0.32), which indicates the existence of a weak direct correlation between the independent variable and the dependent variable, as the value of the coefficient of determination (R^2) (0.10), and this means that the independent variable explains 10% of the variance in The dependent variable. The remaining percentage is due to other factors not studied, and the hypothesis will be tested as well using the statistic T in the analysis as shown in the table.

Table 12: The regression coefficient according to T statistic (sub-hypothesis 3).

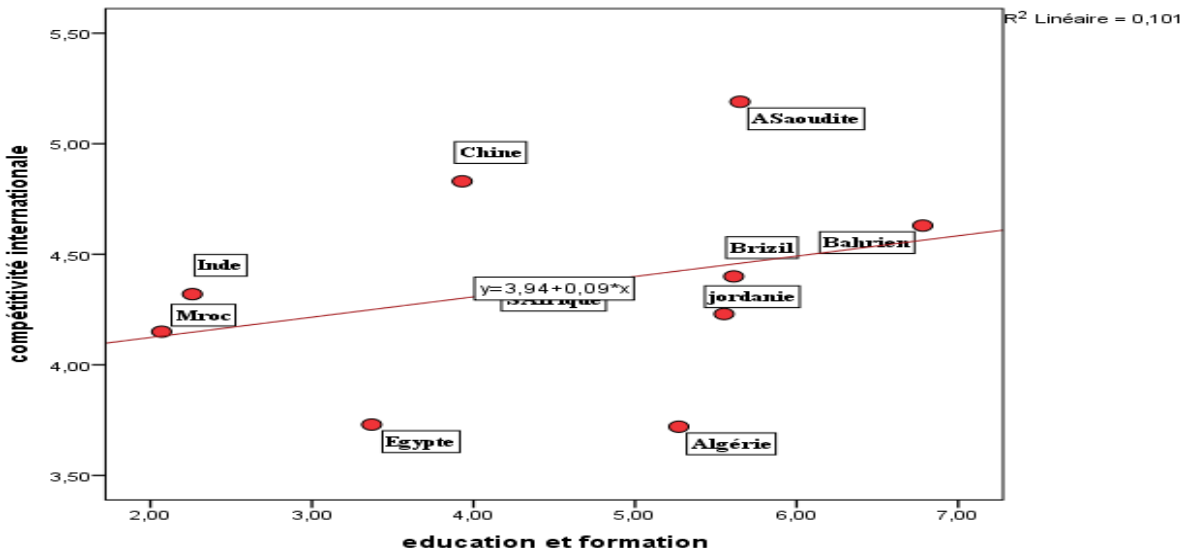
	B	Standard error	BETA	T	SIG
a	3.939	0.463		8.501	0.000
	0.092	0.097	0.318	0.948	0.371

Source: Author calculation based on SPSS.

According to the previous table, the simple linear regression equation can be extracted as follows:

GCI index = 3.56 + 0.17 (The pillar of education and training) + remaining

Figure 5 shows the simple linear regression equation model for the competitivenes index and the pillar of education and training.



Source: Author calculation based on SPSS.

Figure 5: The simple linear regression equation model for the competitiveness index and the pillar of education and training.

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From the above, it can be concluded that:

The value of T was 0.95 and the corresponding level of significance was 0.37, which is statistically insignificant, which means that there is no significant and positive effect of the pillar of innovation and research and development on the competitiveness index in Algeria and the comparative countries, at the level of significance of 5%. In fact, the hypothesis is refused: the pillar of education and training affects morally and positively on the GCI in Algeria and the comparative countries.

iv. *The effect of the pillar of ICT on the GCI*

Fourth Sub-Hypothesis: The pillar of ICT effect significantly and positively on the GCI index in Algeria and comparative countries.

To identify the influence between the independent variable (GCI) and the dependent variable (ICT), and to test the model's ability to interpret, we used both of the correlation coefficient (R), the determining coefficient (R^2) and the modified determining coefficient (R^{-2}) as shown in Table 13.

Table 13: Regression form (sub-hypothesis 4)

R	R^2	R^{-2}	Sig
0.577	0.333	-0.250	0.39303

Source: Author calculation based on SPSS.

The above table showed that the correlation coefficient is estimated at (0.58), which indicates the existence of a weak direct correlation between the independent variable and the dependent variable, as the value of the coefficient of determination (R^2) (0.33), and this means that the independent variable explains 33% of the variance in The dependent variable. The remaining percentage is due to other factors not studied, and the hypothesis will be tested as well using the statistic T in the analysis as shown in the table.

Table 14: The regression coefficient according to T statistic (sub-hypothesis 4).

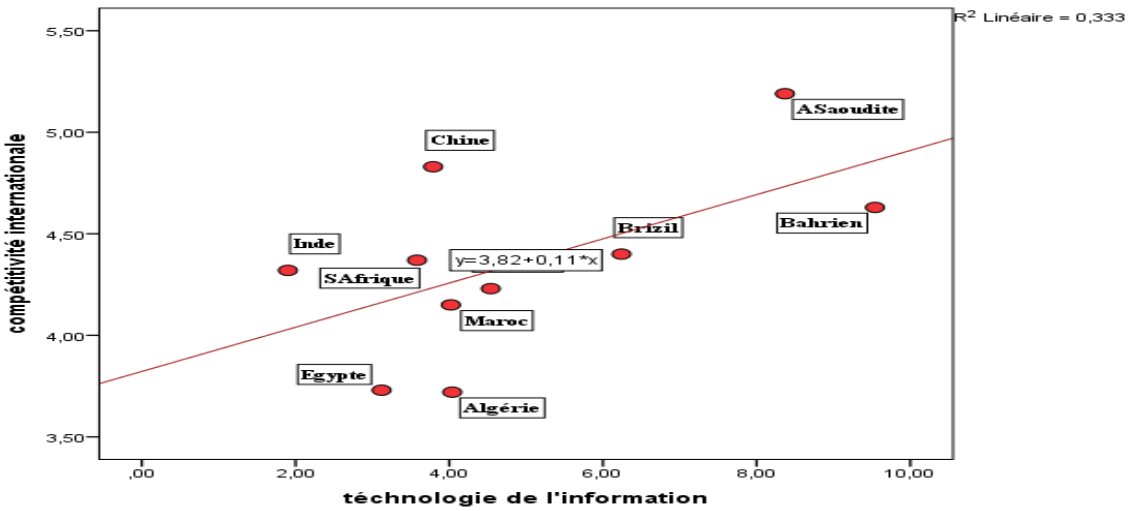
	B	Standard error	BETA	T	SIG
a	3.822	0.295		12.961	0.000
	0.109	0.054	0.577	2.000	0.081

Source: Author calculation based on SPSS.

According to the previous table, the simple linear regression equation can be extracted as follows:

GCI index = 3.56 + 0.17 (The pillar of ICT) + remaining

Figure 6 shows the simple linear regression equation model for the competitiveness index and the pillar of ICT.



Source: Author calculation based on SPSS.

Figure 6: The simple linear regression equation model for the competitiveness index and the pillar of ICT.

From the above, it can be concluded that:

The value of T was 2.00 and the corresponding level of significance was 0.08, which is statistically insignificant, which means that there is no significant and positive effect of the pillar of ICT on the competitiveness index in Algeria and the comparative countries, at the level of significance of 5%. In fact, the hypothesis is refused: the pillar of ICT affects morally and positively on the GCI in Algeria and the comparative countries.

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V. Conclusion

Knowledge has become a decisive factor in competitiveness, growth and wealth. In other words, a real investment capital as important as equipment, machinery. Among the parameters of this economy, the intensification of the use of information and communication technologies (ICT), the central place occupied more and more by innovation in competitiveness, new training profiles and the new capacities which the education system must develop and a favorable and incentive institutional framework.

In this study, we have examined the possibilities of moving from the Algerian economic model to an economic model based on the knowledge economy. We consider that since the end of the 1990s, there has been a willingness on the part of public authorities in favor of scientific and technological research. If the current Algerian economic system is still far from the model based on the knowledge economy, we defend the idea that a window is opening allowing us to move in this direction. The increase in the general level of education and the recent development of research activities, supported by significant means, are all factors in favor of Algeria to reach the technological frontiers.

The result:

- The most important elements of the knowledge economy are the existence of a solid ICT infrastructure, the strengthening of the organizational context for knowledge production.
- Education is the fundamental basis of knowledge and skills, and the most important factor in the accumulation of human capital.
- The choice of innovation as a tool for competitiveness, investment in R&D, are the essential foundations for the construction of a knowledge-based economy.
- Algeria suffers from numerous imperfections, which prevent it from moving towards the knowledge economy.
- The Knowledge Economy Index (KEI) shows that competitiveness in Algeria and the comparatives countries depends moderately on the development of the knowledge economy, so there is an intermediate correlation between the GCI index and the level of development of the knowledge economy in Algerian and the comparatives countries.
- Algeria and the comparatives countries do not rely on the pillar of economic incentive and institutional regime, on the pillar of innovation, research and development and on the pillar of education and training to improve their competitiveness. (Weak bond)
- Algeria and the comparatives countries rely moderately on the ICT pillar to improve their competitiveness.
- There is no significant and positive effect (the significant level of 5%) of the pillar within the KEI index on the GCI index in Algerian and the comparatives countries.

In conclusion, the development of knowledge economy will not be possible without strengthening productive investments in the field of scientific research and in human resources to develop human skills, which is the essence of innovation and competitiveness.

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