The Impact of Knowledge Economy on the Economic Growth

(An Econometric Study: Case of Algeria from 1995 To 2007)

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Abstract: *Due to the urgent need for the integration of all countries into a new economy; the importance of knowledge and its effective role in advancing the development has accelerated, and became a measure of wealth, the reason why such economy is known as "**The knowledge economy**". This is what makes us say that; transformation from an economy driven by industry into an economy run by information and knowledge, and that the creation of wealth is no longer depending on a physical context, but it became the basis of all that is not material and guided in particular by knowledge, in this article we will try to address the impact of the knowledge economy and the economic growth (case study of Algeria).*

At first, we tried to find the most important points related to the economy of theoretical knowledge, and then we moved to another important point which is the relationship between theories of knowledge economy and the economic growth.

As for the practical side, we tried through many indicators and data issued by various agencies and specializing organizations, to rate Algeria among a group of countries. We made an analytical and descriptive study, then we studied the relationship between one of these indicators and the GDP, and due to the lack of data for a long time, we took the patents as an indicator to test causality.

Keywords: *Knowledge, Knowledge economy, Indicators of the knowledge economy, Economic growth, Algeria, Econometric study.*

Résumé: *En raison de la nécessité urgente pour l'intégration de tous les pays dans une nouvelle économie ; qui connait une croissance de l'importance de la connaissance, ainsi que de son rôle efficace dans l'accélération du développement, et qui est devenue une mesure de la richesse. La raison pour laquelle cette économie est définie comme «L'Économie de la Connaissance». C'est ce qui nous pousse à dire que la transformation d'une économie guidée par l'industrie à une économie gérée par l'information et la connaissance, comme ça nous motive à dire que la création de la richesse n'est plus en fonction du contexte physique, mais il est devenu la base de tout ce qui n'est pas matériel et orienté en particulier par la connaissance. Dans cet article, nous allons essayer de répondre à l'impact de l'économie de la connaissance et de la croissance économique (étude du cas de l'Algérie).*

Au début, nous avons essayé de trouver les points les plus importants liés à l'économie de la connaissance théorique, puis, nous sommes passés à un autre point important les théories qui lient entre l'économie de la connaissance et la croissance économique.

En ce qui concerne le côté pratique, nous avons essayé à travers les nombreux indicateurs et les données émises par les divers organismes et les organisations spécialisées, de classer Algérie parmi un groupe de pays. Puis, nous avons mené une étude analytique et descriptive, puis nous avons étudié la relation entre l'un de ces indicateurs et le PIB. Et en raison de l'absence de données pour une longue période, nous avons pris les brevets comme indicateur pour tester la causalité.

Mots clés: *Connaissance, Économie de la connaissance, Les indicateurs de l'économie du savoir, La croissance économique, Algérie, Étude économétrique.*

1. INTRODUCTION

Under the new global variables and the spread of globalization, a new economy is now leading the society towards progress and prosperity. Whenever a new technology emerges; we move away from the agricultural and industrial economy to the knowledge economy; where knowledge and information play an important and effective role, as we move from the idea of survival of the fittest to the idea of survival of the fastest. Thus, knowledge and information technology replaced the capital, and became a key factor for the economic growth.

2. THE THEORETICAL FRAMEWORK

2.1. Knowledge Economy

Definitions varied from the digital economy, to the information economy, to the internet economy, but they all express one economy governed by knowledge; where this latter is the one dominant for the better, and where the idea of survival of the fastest overpowers, and all this to materialize the welfare of society and the individual in particular.

"Dominique Foray" considers Knowledge economy as a subspecialty of economy; mainly concerned with knowledge. He also considers it as a modern economic phenomenon characterized by the change of economies course; in terms of growth and regulation of economic activity. Economists describe this economy as a result of the development of capitalism, a reason why it is also called "post-capitalist economy"[1].

"M-Parken" defines the knowledge economy as the study and understanding of the accumulation process; and the incentives of individuals to discover and gain knowledge and access to what the others know[2].

Knowledge economy can also be defined as: "An advanced economic style based on the widespread use of informatics and internet networks, based firmly on knowledge and innovation and technological development, especially with regard to information and communication technologies"[3].

The Organization for Economic Co-operation and Development "OECD" defined it as a kind of economy based on production, distribution and use of knowledge[4]. It has widely been known as an economy where production and use of knowledge play an essential and important role to achieve prosperity.

In the 2003 United Nations Development Programme, knowledge economy was defined as the dissemination, production and employment of knowledge in all the fields of community activities: economy, civil society, politics and private life; to the upgrade of the humanitarian situation, and this requires the building of potential human capacities, and the successful distribution of human capabilities[5].

Some economists such as Soete (1996)[6] and Neef (1998)[7] believe that: "Knowledge has an effect on the economic structure by creating structural and social changes in the size and type of unemployment, and on how to organize the work and production and the technology policy in place, and it also affects the dependence in the way of life. Knowledge economy is the one that uses knowledge as a factor of production with labor and capital. Knowledge in this sense is limited by innovation and technological progress which leads to the improvement of productivity and thus to economic growth"[8]. Economy self-grows through the "knowledge workers" in facilities; which have increasing returns and where knowledge is treated as a non-competitive commodity and not subject to exclusion partly[9]. The term knowledge economy was used for the first time in 1969 by Peter Draker, and he meant the economy which is based on the creation, production and dissemination of knowledge, and where the latter is not only a factor of production, but also a final product[10]. Machlup Fritz (1962) tried to measure the economic value of knowledge and the integration of knowledge in all operations.

2.2. The Economic Theories

They sought to study and analyze the growth process and the nature of its mechanisms, as it linked between economic growth and technological progress, including mainly:

- ✓ The R.M. Solow model (1957)[11]: through which he discovered the importance of the other (remaining) factors in increasing production, apart from capital and work factors. Education, knowledge, technological (technical) progress and scientific research represent the biggest part. He concluded statistically through his studies (on the economics of agricultural production) conducted on the American economy in the period of 1949-1909 that, individual productivity per hour has multiplied, he also concluded that the remaining factors had a very significant role in the increase of production.

- ✓ The Romer model (1986)[12]: It is the first model of modern internal growth based on a set of economic analysis tools in order to avoid the impact of the diminishing returns law. His model was characterized by two theories namely:

  - o Education by training i.e. knowledge gained through investment in human capital.

  - o Technological knowledge is considered as a group commodity.

  - o Finally, he concluded that the growth rates among countries that gain technology knowledge grow faster than the other countries. Romer has all the credit for the emergence of knowledge economy, thanks to his interest in knowledge and education.

- ✓ The Lucas model (1988): By introducing the human capital[13]; he considered that the marginal productivity of the human capital is decreasing. Also, he concluded that the reason there is a difference in the degree of richness and poverty among different countries is mainly due to the difference in the length of time deployed for training and education. We find that the Northern countries have good developmental rates, because they gave a great importance and sufficient time for training, while we find that the Southern countries have weak developmental rates; due to the lack of their interest or the interest of their members in training. Thus, the policy that has the ability to increase the time of training permanently (favoring the accumulation of knowledge) will have a positive impact on the economic growth.

- ✓ The Romer model (1990)[14]: It is one of the most realistic growth models. It stems from an attempt to explain the process of accumulation of knowledge, and the technological development that seeks profit through the sale of patents. He concluded that the accumulation of technical knowledge is the engine of economic growth, and that the economy which allocates large proportions of capital to research achieves high growth over the long term.

3. THE PRACTICAL SIDE

3.1. The Reality of Knowledge Economy in Algeria

To see the progress of a country in transition to the knowledge economy, the World Bank established the so-called "Knowledge assessment Methodology"; which is about indicators measuring the countries in transition to the knowledge economy and their global rankings. It includes four main pillars, namely: Information and Communication Technology Index, Technological Innovation Index, Education and Human Resources Index, and Global Facilities Index.

Knowledge Economy Index shows whether the environment is conducive for the dissemination of knowledge that can be used effectively in the economic growth. Knowledge Economy Index depends on four indicators considered as pillars of such economy.

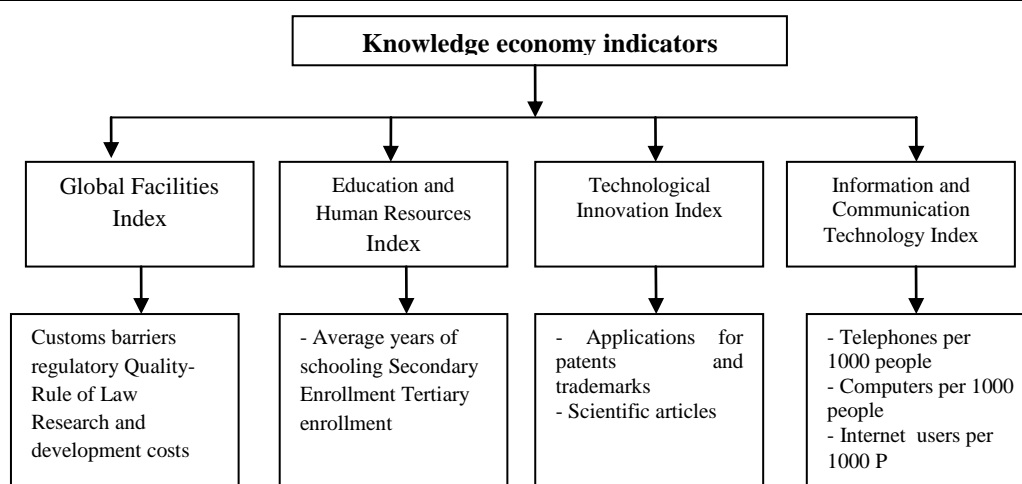This is illustrated by the following figure.

Figure 1. *Indicators of Knowledge Economy*

Source: Prepared by the researcher based on the World Bank website.

Table (01). *Illustrates the rank of Algeria among the countries of the MENA, the first and last country globally in the year (2012) added.*

Indicators States	Rank Globally	Knowledge Economy Index	Knowledge Index	Global Facilities Index	Technological Innovation Index	Education and Human Resources Index	Information and Communication Technology Index
1 Sweden	01	9.43	9.38	9.58	9.74	8.92	9.49
2 Emirates	42	6.94	7.09	6.50	6.60	5.80	8.88
3 Bahrain	43	9.60	9.98	6.69	4.61	6.78	9.54
4 Oman	47	6.14	5.87	6.96	5.88	5.23	6.49
5 Saudi Arabia	50	5.96	6.05	5.68	4.14	5.65	8.37
6 Country	54	5.84	5.50	6.87	6.42	3.41	6.65
7 Kuwait	64	5.33	5.15	5.86	5.22	3.70	6.53
8 Turkey	69	5.16	4.81	6.19	5.83	4.11	4.50
9 Jordan	75	4.95	4.71	5.65	4.05	5.55	4.54
10 Tunisia	80	4.56	4.80	3.81	4.97	4.55	4.89
11 Lebanon	81	4.56	4.65	4.28	4.86	5.51	3.58
12 Iran	94	3.91	4.97	0.73	5.02	4.61	5.28
13 Algeria	96	3.79	4.28	2.33	3.54	5.27	4.04
14 Egypt	97	3.78	3.54	4.50	4.11	3.37	3.12
15 Morocco	102	3.61	3.25	4.66	3.67	2.07	4.02
16 Yemen	122	1.92	1.58	2.91	1.96	1.62	1.17
17 Sudan	138	1.48	1.82	0.48	1.44	0.84	3.16
18 Myanmar	145	0.96	1.22	0.17	1.30	1.88	0.48

Source: Prepared by the researcher based on data from the World Bank.

The following table shows the rank of Algeria globally in the knowledge economy during the three years 1995, 2000, 2012 according to the World Bank data among 145 countries. We notice the delay of Algeria with two ranks. It ranked 108th in 1995 then declined to occupy the rank 110 in 2000, then advanced with 14 ranks to take the 96th rank within the global ranking in the knowledge economy.

Table (2): *Indicators of Knowledge Economy and the rank of Algeria globally*

Indicators \ Years	Rank	Knowledge Economy Index	Knowledge Index	Global Facilities Index	Technological Innovation Index	Education and Human Resources Index	Information and Communication Technology Index
1995	108	3.50	4.05	1.85	3.41	3.88	4.87
2000	110 (-2)	2.85	3.44	1.09	3.25	3.96	3.11
2012	96 (+14)	3.79	4.28	2.33	3.54	5.27	4.04

Source: Prepared by the researcher based on the World Bank data.

3.2. An Econometric Study

We try through this section to know whether there is a relationship between the number of patents and the GNP (Gross Domestic Product) of Algeria by using the methods and means of economic measurement, therefore, we analyze causality between variables (Granger casualty) in order to know the nature of this relationship (unidirectional, inverse, reciprocal).

But we cannot make a causal test only if the time series are stable; hence, we use the method of Dickey Fuller test for the unit root.

Table (03): *The study variables*

Variable	The study period	Symbol	Source
GDP in Algeria	1975 - 2007	PIB	FMI
The number of patents in Algeria	1975 - 2007	Patent	INAPI

Source: Prepared by the researcher based on the World Bank website.

We study the stability of the time series: the following table is a summary of the stability of the variables series studied.

Table (04): Summary of the stability of time series variables.

Variables	Stable		Became stable	
	Yes	No	Difference 1	Difference 2
PIB		×	×	
Patent		×	×	

Source: Prepared by the researcher, based on the Eviews 7 program.

Figure (2): *Shows the graph of the Patent series in this period*
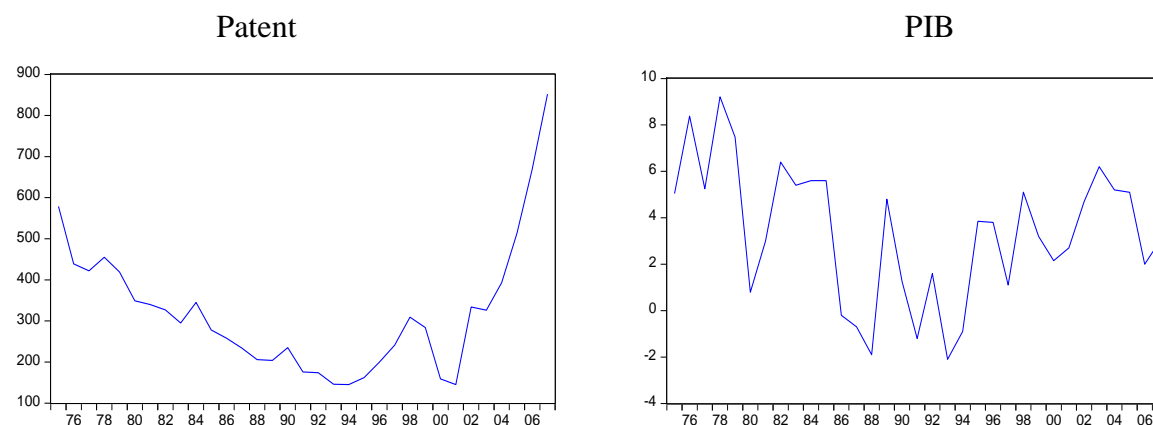
Source: Prepared by the researcher, based on the Eviews 7 program.

Table (05): *Shows the relationship between patents and GDP*

	PIB	Patent
Patent	1	0.078144
PIB	0.078144	1

Source: Prepared by the researcher, based on the Eviews 7 program.

We note that there is a relatively weak relationship between patents and GDP.

It means that the correlation coefficients do not give sufficient economic interpretation, because they do not always determine the impact direction, and the significant gains of such transactions do not mean in any way the existence of a relative relationship. The variables are linked with each other functionally; therefore, the causality test was used to determine the type and direction of the relationship between economic variables.

We test Granger causality between the first differences of the product and the first differences of the number of patents; in order to study the causal relationship between them.

The appropriate test for causation study is the Fisher test, and it should be based on the following assumptions:

H_0 : Y_{2t} does not cause $y_1 t$

H_1: Y_{2t} causes $y_1 t$

The causal relationship between the variables:

Pairwise Granger Causality Tests			
Sample: 1975 2007			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
PIB does not Granger Cause Patent	30	.15950	0.8534
Patent does not Granger Cause PIB		1.53207	0.2357

Source: Prepared by the researcher, based on the Eviews 7 program.

Table (06): *Summarizes the causal relationship between the variables*

	Casualty according to Granger		Lack of Casualty	
	From patents	To patents	From patents	To patents
GDP			×	×

Source: prepared by the researcher, based on the Eviews 7 program.

Results of the examination of Granger causality in the above table show that: considering the status of "GDP growth causes change in the number of patents", we note that the probability corresponding to Fisher F statistic is much higher than the moral levels accepted; namely id α = 5%. This means that the GDP growth does not cause a change in the number of patents. As for the case of "change in the number of patents causes GDP growth"; we note that the probability corresponding to Fisher F statistic is higher than 5 %. Finally, we conclude that there is no two-way relationship, which means that the change in the number of patents also does not cause a change in the growth rate of real GDP, considering the data obtained, so we accept H_0 and reject H_1.

4. ANALYSIS

We can say that in this period, the study period, there is no relationship between patents and GDP, and this is due to the significant delay in the patents in that period; where Algeria suffered from a decade of political instability, but after the economic recovery program; there was an increase in patents because it encouraged the development of scientific research and the technological innovation in Algeria, in order to integrate into the knowledge economy, and this is evident through the high increase of expenses on research and development in Algeria. Such number of

patents remains weak compared to the increase of GDP. This is due to the large proportion of the hydrocarbons proceeds in the value of the latter, and which was the reason for the result obtained.

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