

## **Conceptual Foundations of the Knowledge Economy and Presentation of Its Performance Indicators**

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**Abstract:** *Recent studies on the evolution of the world economy show the new applications centred on the knowledge economy. This article aims to provide a comprehensive overview of the historical roots, the conceptual foundations and the recent debates around this new discipline. Moreover, the knowledge economy approach its potential in terms of development, growth, improvement of competitive positioning and strengthening of the well-being of populations and social peace so sought after by societies.*

*In addition, this paper offers a presentation of economic indicators measurement in the Moroccan context, which shows that, in spite of the multiple assets which it has; this country is lagging behind considerably in matters of knowledge economy, in particular at the level of its educational system, its R&D results and in terms of innovation.*

**Keywords:** *Knowledge Economics, Indicators, Research, Innovation.*

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### **I. Introduction**

The history of global economic growth is still marked by periods of crisis, local or global, leading to an economic slowdown activity forcing states to anticipate signs of slowing economic models. This has led them to set up an economic watch, capable of developing a competitive advantage and competitiveness through among other things, the development of their scientific research and technological innovation systems, and their ability to create, innovate and exploit the results obtained. Guellac, D. (2009), who concluded the relationship between knowledge and development, confirmed this finding. This author has always worked to identify this relationship in the writings of classical authors such as Smith, A., Marx, K. and Schumpeter, J.A. From the 1960s on, an awareness of the strategic importance of this relationship began to win over specialists, especially sociologists and economists, who began to define its contours.

The Publication in 1996 of the OECD report entitled "The Knowledge-Based Economy" made the concept widely disseminated and popularized. This has led authors such as Foray, D. (2018) and Lundvall, B.A. (1996) to conclude that: the present world is undergoing a new transformation of the capitalist model, based on knowledge, a mutation that puts an end to the old periods characterized by the processes of accumulation of physical capital. The integration of the Moroccan economy into this new mode of development has thus become a necessity imposed by the risk of its isolation at the regional and international level and the loss of opportunities capable of transforming and elevating its economy to the rank of developed countries with high benefit.

In order to better master the objective of this paper, oriented towards diagnosing the state of the knowledge economy in the Moroccan context, a number of questions need to be asked: What definition can be given to this new knowledge-oriented economy? What is the origin and conceptual development recorded by this new discipline? What are its measurement indicators? Finally, what are the specific characteristics of this discipline in the Moroccan context?

A first point will thus define this new economy and present its objectives and theoretical underpinnings while trying to identify its main fundamental concepts. The second point of this article will focus on the presentation of the indicators for measuring this economy. A final point will also be devoted to the presentation of economic situation in the Moroccan context, in the light of the number indicators of national and international organizations. The article methodological framing is based on documentary research that will allow us to better understanding the purpose and concepts of this new discipline and to explicate the contours of the knowledge economy in the Moroccan context.

## **I- The knowledge economy: a concept rich in perpetual development.**

The development history of the knowledge economy is relatively recent compared to other human activities of production, consumption, exchange or distribution. It is a history marked by a rapid evolution of its concepts and an important dimension of its development prospects and its areas of intervention. Indeed, as this Aberkane, I.J. (2015), the knowledge economy, unlike the economy in its traditional version, is based on an infinite resource formed by "knowledge" whose potential will allow unlimited economic applications, which will allow growth indexed to knowledge, also infinite. The importance of this inexhaustible source of growth was also the conviction of several influential authors and figures in the economic and political world. Jimmy Carter quoted by Fabre, R. et al. (2018), speaking on the oil shock of the 1970s, sums up the potential of the knowledge economy confirming, "if we continue to index the dollar to raw materials, its potential is great but limited. In the other side, if we would have to index our currency to knowledge, its potential would be infinite". Steve Jobs, in an interview conducted on the sidelines of a symposium on geopolitics held in Paris in 1984, recalled the importance of this economy by confirming "we need a strong software industry, because software is the oil of the 80s and 90s, of this computer revolution".

Aberkane, I.J. (2015), attests that this confirmation is still valid today and explains that President Barack Obama has established the tradition of "entrusting to geeks, such as Nobel laureate Steven Chu or Professor Ernest Moniz, the very strategic secretariat for energy", which paves the way for the United States to a resurgence of the knowledge economy. Thus, our objective at the level of this first point will be centered on the presentation of the theoretical anchoring of this discipline and on the debate between the various authors regarding its appearance, its development and its impact on the economic progress of countries.

### **1-1- Theoretical anchoring of the knowledge economy**

The historical development of the knowledge economy took place in two phases, that from the 18th century to the middle of the 20th century and the one linking this last period to the present day. The identification of these two major phases is linked to economists' interest in the concept of knowledge and its appropriation in the economic field, which has been the subject of study since the middle of the 20th century. Indeed, Bouchez, J.P. (2014), explains that from the 1960s on, several authors stressed the importance in the economic sphere of knowledge and knowledge-related activities.

#### **1-1-1- The first steps of knowledge in the economic sphere**

The birth of the knowledge economy or as some like to call it, "knowledge-based economy", "capitalism of Knowledge", "Cognitive capitalism", "immaterial" or "post-industrial" is, as Foray, D. (2018), "a historical process that runs through the 20th century". He adds that the evolution of this economy has not been brutal, but rather a slow and gradual evolution. Thus, a step backwards becomes necessary in order to verify the merits of the confirmations of one or the other and the degree as well as the forms of use of knowledge especially in the economic sphere.

- **Classical and pre-classical economists:** Some authors explain that the first use of knowledge in the economic sphere dates back to Montesquieu, which links the mechanisms of supply and demand to knowledge through production. Other authors such as Hume, D. and Smith, A., recognize the positive impact of knowledge on change and progress and confirm that the advancements made in certain tools and machines were the result of the inventions of some workers who used their technical skills and knowledge. Moreover, this current of thought considers knowledge to be a component of the factors of production of limited importance.
- **The Industrial Revolution:** In contrast to the classics, the neo-mercantilist current, which is a less well-known current of analysis compared to other currents of economic thought, highlights the industrial, commercial and above all technical advance as a factor in England's domination over its rivals at the time of the industrial revolution. This technical progress and especially the use of knowledge in the industrial world led to the invention and development of steam engines, which had marked a major turning point in the development of industries and in maritime and rail transport.
- **The neoclassical current:** Cortés, D. (2009) explains that the neoclassical current, and unlike the classical current, considers knowledge not as a component of the factors of production but as a concept that defines other variables than factors of production, such as the organization of production. Thus for this author technological progress is considered by this current as a parameter included in the production function. Nonaka, I. and Takeuchi, H. (1995) criticize this neoclassical vision and explain that they are interested in a single type of knowledge, namely prices and their training. These two authors add that this current of economic thought places little importance on knowledge, especially tacit knowledge, and their creation.

- **The Austrian School of Economics:** Machlup, F. (1993) explains that the presence of ignorance, uncertainty is inevitable at every stage of the economic process and that economic uncertainty is strongly influenced by "uncertainty of knowledge throughout the field of causal links of production, i.e. technology" and that economic growth is dependent on the progress made in this knowledge. The point of divergence between this school and the neoclassical current lies in the existing relationship between knowledge and information. Thus, for Arrow K.J. (1962), quoted by Aimar, T. (2010), the two terms mean the same meaning since for this author "knowledge, produced by a specialized sector (research and development), is intended for the exchange by which it is mechanically transformed into information."

### **1-1-2- The birth and development of the knowledge economy.**

The work of Drucker, P. or Machlup, F. and their contributions in the identification and development of the knowledge economy constitute the culmination of a number of work and decisions, in particular, policies that need to be developed in order to better understanding the birth of the knowledge economy.

- **Bush's Report, V. (1945):** This report is the cornerstone of the knowledge economy, presented to President Franklin Roosevelt and subsequently to President Truman H., and established the U.S. strategy for scientific research throughout the post-war period. Bush, V. (1945) based its model on innovation that begins for this author with basic training and research that participate in the development of applied research important component of technological progress.

- **U.S. Economists:** These economists are a valuable contribution to the conceptualization of the knowledge economy. Nelson, R.R. (1959) was thus one of the first to emphasize the role of public authorities in the development of knowledge through the analysis of the process of funding scientific research that nations must adopt. Arrow K., through the publication in 1962 of two articles, emphasized the allocation of resources for knowledge and knowledge-based activities and the main elements of the formation of human capital. Romer, P.M. (1986) presented the first model of endogenous growth, which for Howitt, P. (2004) is an extension and a renewal of the neoclassical theory of economic growth, particularly the exogenous growth model developed by Solow, R.M. Lucas, R.E. and Barro, J.R. have improved this model. In addition, Azuelos, M. (2016) explains, "the term "seen knowledge economy" - seems to have been first used by Peter Drucker in 1969 to refer to all sectors and activities "inspirally" ". Drucker P. (1992; 1993) later adds that knowledge is currently the main economic resource, and even more so, he considers it to be the only source that counts today, while other sources or factors of production (capital, labor and land), without disappearing, they contribute less.

### **1-1-3- The Knowledge Economy: New Trends.**

Foray, D. (2018) presents in his book "The Knowledge Economy" new trends in the recent transformations of knowledge-based and knowledge-based economies. For this author, the first trend concerns the shift of sectors qualified by Baumol, W. (1967) from stagnant sectors, especially health and education, to the progressive part of the economy. The second trend concerns the decentralization of its standard places to find itself according to Foray, D. (2018) among individuals. Finally, the progress made in the digitalization of the economy and its impact on the development and progress of the knowledge economy are another avenue for future developments in this discipline.

### **1-2- Attempt to define the knowledge economy.**

In order to better understand this new representation of the knowledge-based economy, it would be preferable to define the concept of "knowledge" and distinguish it from other very similar concepts, namely "information," "data" and "wisdom". It would also be important to present the different types and forms of knowledge, as well as its different management techniques. Finally, we will conclude this first point with a definition of this discipline.

#### **1-2-1- The knowledge concept**

The definition of knowledge has evolved according to the perception that each current of thought has had of this concept. Drucker, P. (1993), conceives conceptual evolution in three phases: firstly the classics, secondly that consider knowledge as part of the factors of production, thirdly, the period until the second half of the 19th century that traced the independence of knowledge of factors of production. The objective related is to increase the productivity of these factors, where knowledge applied to the process of work. From the second half of the 20th century, it was, for this author, the era of the managerial revolution where knowledge was applied to the "knowing about" "know about" and "knowing how" "know how". Drucker, P. (1994), later presented knowledge as "the only resource that makes sense today. Traditional factors of production - land (i.e. natural resources), labor and capital, have not disappeared, but they have become secondary. They can also be obtained

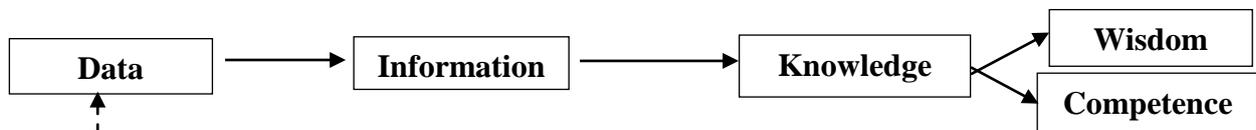
easily, provided there is knowledge. Moreover, knowledge in this new acceptance means knowledge as a raw material (utility), knowledge becomes a means of acquiring social and economic results.

**1-2-2- The triptych of knowledge - information - data and creation of knowledge**

Rappin, B. (2014) explains that the concept of knowledge cannot be defined outside the presentation of the concept "information" and "data", asserts that "the concept of knowledge in literature is thought in complementarity with those of data and information" and that this concept makes sense in a game of differentiation with the other two concepts. Boubaker, L., Mellal, L. and Djebabra, M. (2010), confirm that this triptych aims to define the process of knowledge creation and use two models for this purpose, the first being that of Mack, M. (1995) and the second is that of Siemieniuch C.E. and Sinclair M.A. (1999). These two models show that the data are the origin of the information that is in turn the origin of the knowledge and that the latter constitutes the result of the following relationship: Data Information Knowledge, these two models differ in the outcome of this relationship and in the enhancement of this knowledge.

For Mack, M. (1995) knowledge leads to competence, which constitutes a continual improvement in knowledge and allows the creation of new data, which continuously reproduces the Data Information Knowledge loop. Whereas for Siemieniuch C.E. and Sinclair M.A. (1999) the Passage Given Information leads to instant knowledge that creates wisdom through experience. Thus, Figure 1, inspired by the work of Siemieniuch, C.E. and Sinclair M.A. (1999) and Nonaka, I. (1994), makes this relationship possible.

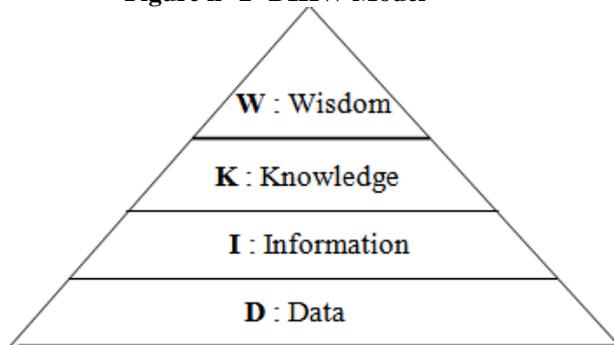
**Figure 1- Knowledge creation cycle based on the models of Mack, M, Siemieniuch C.E. and Sinclair M.A.**



Source : Boubaker, L., Mellal, L. et Djebabra, M. (2010). P. 154

Another model of analysis of knowledge creation was based on a prioritization of the three components. For this model, named "DIC (D: Data; I: Information; C: Knowledge)" the logic adopted is similar to other models, since information is an interpretation of the data to give it meaning and knowledge is an interpretation of the information to give it meaning. This model has been improved Ackoff, R.L. (1989) who has incorporated a new element, it is the wisdom that will constitute the top of the pyramid and which this author calls an evaluated understanding. The model proposed by Ackoff, R.L. (1989) is named DIKW (D: Data or Data; I: Information; K: Knowledge or knowledge; W: Wisdom or Wisdom). Thus, Figure 2 gives a presentation of the DIKW model.

**Figure n° 2- DIKW Model**



Source : Rowley, J. (2007). P. 164

**1-2-3- The typology of knowledge**

The complexity of defining the concept of knowledge linked not only to confusion with the notion of information or data but also to the multiplicity of forms of knowledge identified. Thus, several classifications have been developed in order to present a typology of knowledge. This section will therefore be an opportunity to present the main proposed classifications of this concept.

The classification of Nonaka, I and Takeuchi, H. (1995), which constitutes the main proposed classification of this concept, was based on the work of Polanyi, M. (1962; 1966), who proposed taxonomy between "tacit knowledge" or "personal knowledge, specific to a given context and difficult to articulate in

formal language. It can be very difficult to communicate or share with others" and "explicit knowledge" presented as "scientific information, facts and knowledge that can be articulated, codified and therefore formally transferred, through systematic methods, such as rules and procedures."

This distinction was at the origin of the theory of the creation of organizational knowledge presented by Nanoka and Takeuchi (1995).Lundvall, B and Johnson, B. (1994), present another knowledge classification consisting of four types: "Know-how" that essentially relates to tacit knowledge with experiences and skills. "Know-who" or relational knowledge that Daraut, S. (2010) describes as "particular and selective social mechanisms of the type of reputation, relationships of trust and power relations. "Know-what" or factual knowledge is essentially explicit, it refers, as Deneux, D., et al. explains. (2002), knowledge "necessary for the identification and designation of a phenomenon or state of affairs (e.g., clues collected during a judicial investigation)". "Know-why" or knowledge of understanding, which refers to knowledge necessary for the interpretation of factual knowledge, are essentially scientific knowledge or knowledge of principles and laws, produced particularly by specialists.

#### **1-2-4- Attempt to define the knowledge economy**

One of the difficulties faced by this research work related to the identification of a clear and universal definition of the knowledge economy.Finding identified by Smith, K. (2002) which concludes that "Weakness, if not complete lack of definition, is omnipresent in the literature... it is one of the many inaccuracies that make the notion of 'knowledge economy' so rhetorical rather than analytical". The attempt to define and present the knowledge economy will take as its origin the work of American economists and in particular the work of Arrow, K. (1962), which considers that the activity of innovation is totally dissociated from that of production in its classical conception. Azuelos, M. (2016) presents Arrow, K. (1962)'s innovation activity as an activity of producing knowledge from skilled labor and capital and whose final product comes in the form of information exchanged in a market. Azuelos, M. (2016) also considers that this author has highlighted the importance of learning by doing or learning by using in the design and production of knowledge. Paillard, S. et al. (2001), based on Arrow's model, K. (1962), conclude, based on much empirical work, which some agents belonging to research and development laboratories and knowledge industries have specialized in the production of knowledge that was at the origin of the development of a sector dedicated to this function. The first use of the term "knowledge economy" is attributed to Drucker, P. who attributes intellectual paternity, according to the presentation of Azuelos, M. (2016), to Machlup, F. (1962) which identifies in this sector "education, communication activities, information processing equipment, information services and other activities associated with information." Presentation also adopted by the OECD (1996) which defines knowledge economies as "those that are directly based on the production, distribution and use of knowledge and information."

## **II. Indicators For Measuring The Knowledge Economy.**

Viginier, P. et al. (2002) identify two main advantages related to the measurement of the knowledge economy. First, the measurement of this economy will allow us to decide on the new dynamics of economic growth driven by knowledge, knowledge and the pace of development and transformation of economies towards the knowledge economy. Second, measuring the knowledge economy identifies a set of indicators that can assess and compare the level of performance of different countries and identify their advantages and weaknesses relative to other partners.Moreover, one of the difficulties facing the knowledge economy is undoubtedly the problem of its measurement and quantification, reported by Foray, D. (2018) which explains, "Most knowledge phenomena are very difficult to observe". Thus, in order to better master this new vision in the management of the economic case, it would be appropriate to devote a first point to the study of the difficulties associated with measuring this discipline before presenting its main indicators of measurement.

### **2-1- Measuring the knowledge economy a difficult task in different aspects**

Perhaps one of the main challenges facing this study is the measurement of the knowledge economy. Indeed, Archambault, J.P. (2004) argues, "the immaterial is more difficult to quantify than the material, at least not with the same instruments." The problem of measuring the knowledge economy is also compounded by the limitation of the areas concerned by the indicators of measurement of this discipline, leaving several sectors and several agents outside the framework of analysis of this discipline. Foray, D. (2018) summarizes the main problems of measuring the knowledge economy in four points that limit the scope of analysis of its measurement indicators compared to other conventional economic indicators.The knowledge economy is a largely unobservable phenomenon, especially in its tacit state because this type of knowledge is specific to each individual;Difficulty in defining a stable model of converting inputs into outputs in knowledge economy;Difficulty measuring the available stock of knowledge;Specialty of the depreciation and obsolescence of knowledge

## **2-2- Indicators for measuring the knowledge economy**

The evolution of the contribution of the knowledge economy to the progress of countries and its increasing integration into their economic and social fabrics has led several institutions and specialists to identify a battery of indicators to measure the impact and contribution of this discipline in economic development, the level of knowledge production, the stock of knowledge and their flows, the profitability and productivity of investment in this area. Thus, based on the contribution of the OECD, the European Commission and the diagnosis of the knowledge economy in some countries, we can propose in the following a battery of indicators to measure the knowledge economy.

### **2-2-1- Indicators tracing scientific and technological activity**

Scientific activity refers to all actions undertaken at national or international level in order to produce scientific and technical knowledge. To this end, several indicators, developed by different organizations, are used to track and trace this effort. Examples include OECD reports, the European Commission and the OST's science and technology indicators. Thus, through the analysis of these different reports, we can summarize the indicators that allow the monitoring of this effort through the analysis of four indicators.

- **Research and development activities:** The measurement of research and development activities is generally linked to the measurement of two inputs: financial investment in research and development and human resources used in this area. These indicators are monitored regularly and standardized through several databases. Including the Frascati manual published by the OECD, which has adopted a hierarchy and comparison between different countries. This manual identifies three types of research activities: basic research, applied research and experimental development, and presents research and development in different areas of activity and by funding sources.
- **Patent tracking:** Patents are reliable indicators of measuring countries' innovation efforts, since their registrations are for not only research and development laboratories, but are generalized to all inventors. Patents provide information on a particular aspect of economic development as it is an indicator of new ideas to be marketed.
- **Monitoring scientific publications:** Scientific publication is a means of exchange and transmission of information within the community of scientists and specialists and a privileged tool in the hands of researchers to present the results of their studies and research. These publications first require a passage through readings, verifications of results and reviews of methodological rigor carried out by specialized and independent reading committees or peer reviews. Library studies analyze the links between the scientific system and technological knowledge through the crosschecking of data from patents and those from library and enable the transformation and reorganization of the field of research (science mapping).
- **Measuring the degree of scientific and technological specialization:** A country's degree of scientific and technological specialization is thus a necessary condition for ensuring the competitiveness of countries and successfully integrating them economically into the global economy. Thus, the measurement of this degree is linked to a number of indicators, mainly patent data, scientific publications and research and development. Indeed, scientific publications provide information on the degree of specialization of countries in different scientific disciplines and patents are an indicator of their degrees of specialization in the technological field.

### **2-2-2- Indicator measuring the contribution of human resources to the knowledge-based economy**

Despite the importance of human resources in the development and dissemination of knowledge-based economies, the measurement of its contribution to these economies and the definition of indicators of measurement of this contribution remain limited. This situation is caused by the difficulty of quantifying and measuring the skills of individuals and on the other hand, the impact of human resources on this area remains variable and depends on skills. The achievements and the spirit of openness and communication of any individual involved in this economy. In order to measure the contribution of human resources to the knowledge economy, two data sources will be used: The contribution of the field of education training:

- **Measuring the contributions of the field of education:** training allows to inform about the level of knowledge acquired or human capital built through the process of training and education, thus allowing accounting for the level of investment and the stock of human capital. The measurement of this contribution done, following two groups of indicators identified by different bodies such as the OECD, EUROSTAT, UNESCO (indicators tracing the stock of human capital; - indicators tracing investment in human capital). The contribution of personal qualifications: National or Community surveys (EUROSTAT surveys) on

labor forces are the main sources of information on the contribution of personal skills to the knowledge economy. The analysis of personal qualifications is based on the analysis of human resource stock indicators and indicators related to their mobility.

EUROSTAT, UNESCO (Indicators tracing the stock of human capital; - indicators tracing investment in human capital).

- **The contribution of personal qualifications:** National or Community surveys (EUROSTAT surveys) on labor forces are the main sources of information on the contribution of personal skills to the knowledge economy. The analysis of personal qualifications is based on the analysis of human resource stock indicators and indicators related to their mobility.

### **2-2-3- Indicators tracing knowledge products**

Several surveys were conducted to measure innovation, these surveys had different objectives, we will retain in this part three surveys:

- The "YALE 2" survey aims to study the degree of ownership of innovation;
- "CIS" surveys of European community and OECD countries to measure the factors influencing innovation and the study of the scope and impact of technological innovation in the enterprise;
- The SESSI survey, which presents the skills required of companies to innovate.

### **2-2-4- ICT Diffusion Measurement Indicators**

The development and progress of the knowledge economy has always been influenced by the development of ICTs, which have become essential instruments for these economies and particularly in the development of education activities requiring all countries to generalize them in order to take advantage of their positive effects. The level of ICT diffusion remains an unreliable indicator of the fact that these data differ from country to country, which raises the problem of harmonization of these data. Various organizations have tried to overcome this problem, so and in collaboration with the European Institute of Business Administration, the World Economic Forum has defined an index called the "Network Readiness Index" which allows countries to rank according to their capacity to exploit ICT and the level of digitization of their economies. Despite the difficulties associated with measuring and presenting indicators specific to the knowledge economy, we have tried at this second point, thanks to the work of several authors and specialized organizations, to move closer to the indicators of measurement of this new discipline. The next item will be devoted to the presentation of the characteristics of the knowledge economy in the Moroccan context.

## **III. Aspects of the knowledge economy in the Moroccan context**

"The economy has changed. In just a few years, a new component has emerged as a key driver of economic growth: the intangible, this assertion by Levy, M. and Jouyet, J.P. (2006), is a summary of the state and evolution of the global economy. This growing role of knowledge-based economies is also linked to the rapid progress they can generate for all sectors of economic activity and improving their competitiveness. The Moroccan economy, like most developing economies, is particularly sensitive to the progress made by knowledge economies, this sensitivity is first linked to the nature of these economies characterized by their openness to the international economy, by the potential, they have and then to the desire to attract FDI oriented towards sectors with high development potential. , by a set of signed agreements and by its desire to become an emerging country.

This third point will then be directed towards the presentation of the state of affairs of the knowledge economy at the level of Morocco through a set of indicators. First, we will present a brief history of the development of this economy in the Moroccan context before drawing up its state of affairs in the light of different databases.

### **3-1-Prior to the establishment of the knowledge economy in Morocco**

Morocco's integration into the knowledge economy has always been a major challenge for which several reforms have been put in place to create a favorable environment for the creation of knowledge-intensive activities. Indeed, the IJC (2013) asserts that Morocco was a pioneer in reforms related to the telecommunications sectors and in particular the field of mobile telephony allowing it, according to the center, to be "one of the countries with the highest tele-density in the region". At the same time, Morocco has based its development strategy on the creation of industrial zones and cities with high knowledge potential or smart cities, which has allowed it to attract FDI mainly oriented towards areas allowing considerable technological and innovation.

This industrial zone development strategy has been accompanied by the adoption of various sectoral development strategies, including first the vision "Digital Morocco 2013" enhanced by the strategy "Morocco Digital 2020". This strategy to support activities oriented towards the knowledge economy has been accompanied by important reforms in the education system through the 2009 emergency programme of education in Morocco, the reform of the Bachelor, which constitutes a serious reflection on the performance of the LMD system in Morocco. Improving the political and institutional environment was also one of the major strengths of the policy of supporting knowledge- and knowledge-based economies through the reform of the constitution in 2011, which established the foundations of institutional governance, the reform of the organic law on finance laws promulgated on 02 June 2015, the adoption of liberalization and privatization policies. , tax reform and the easing of certain rates...

### **3-2- Morocco and the knowledge-based economy: States of the Place**

Djefflat, A. (2008) explains that international competitiveness would be competitiveness around innovation and each country's ability to make the most of and mobilize its resources and capabilities in terms of knowledge and innovation. It also adds that several states without natural resources have been able to establish themselves on the international stage thanks to their potential in the fields of knowledge, knowledge and innovation. On the other hand, we can see that different countries have diversified and inexhaustible stocks of raw materials occupying the last places in terms of competitiveness and innovation. As a result, the analysis of Morocco's integration in the knowledge economy inevitably requires a detailed analysis of the economy's own indicators. Thus, four variables will be used to present the state of the situation of this economy in the Moroccan context.

#### **3-2-1- Research and development activities**

The proposed analysis of research and development activities will describe the national research and development system and the innovation system, based on the analysis of four indicators detailed above. This analysis will also be supplemented by a comparison of Morocco's position with other rival countries.

##### **3-2-1-1- Research and development staff**

By following the standards of the Frascati Manual, (2015) this indicator is defined as the set of "highly qualified researchers, specialists with a high level of technical experience and training, and support staff directly associated with the execution of research and development projects and activities. In accordance with the definition of research and development set out in this manual, this concept encompasses all areas of knowledge." According to the report of the Hassan II Academy of Sciences and Techniques, (2019) the number of research and development staff for the 2016 financial year is set at 54,087 individuals spread over 581 institutions. The majority of this workforce (91%) public university or educational and research institutions, compared to only 9% for universities and private companies. Regarding Morocco's position relative to other countries, the major observation is that Morocco lags behind other comparable countries; this observation was noted following the study of the total personnel index of R 'D per thousand assets estimated at 4.1% and the number of researchers per million inhabitants estimated at 1,469.30, these two indicators rank Morocco behind Tunisia Jordan or Egypt.

##### **3-2-1-2- Financial resources for research and development.**

The DIRD or Gross Internal Research and Development Expenditure index adopted by the OECD's Frascati Manual represent this indicator. With an amount of 1.58 billion dollars of PPA, Morocco is ranked 51st out of 128 countries. This indicator recorded a substantial increase of 233% during the period 2011-2016. This improvement is due not only to the contribution of the public sector, but also to the efforts of the private sector, which account for 30% of the overall increase in 2016. At the international level, Morocco is classified as one of the countries that devote between 1% and 2% of their GDP to research and development activities such as Turkey or Malaysia. Developed countries spend a rate of more than 2%.

##### **3-2-1-3- Scientific production**

The number of publications of international indexed and peer-reviewed journals measures this indicator. This analysis shows, according to the Hassan II Academy of Science and Technology (2019), that between 2010 and 2016 Moroccan publications increased by 50% from 1,217 to 1859. These results, despite the progress made, remain insufficient in relation to the number of publications in the countries of the region such as Tunisia, Algeria or Egypt.

#### **3-2-1-4- Patents**

The patent is one of the main indicators for estimating the weight of innovation in the national research system. According to the latest OMPIC report, (2020) the number of patent filings in Morocco has increased considerably between 2015 and 2019 at 167%, thus reaching a total number in 2019 of 2,730 patent applications. This increase is mainly due to applications from foreign sources, which have been estimated to increase at 218%, while domestic applications have fallen by 14% during this period, bringing the number from 224 applications to 192. Compared to other countries with close economies, OMPIC (2020) concludes that Morocco's situation is quite advanced as it occupies the second place in terms of patent applications filed behind South Africa and before Egypt ranked third.

#### **3-2-2- Human capital.**

The valuation of human capital is currently the centerpiece of any country's development strategy, which allows it to have the necessary conditions for economic growth and development, as Morocco seeks a favorable position among the so-called developed countries. Indeed, the OECD (2017) concludes that Morocco "should significantly accelerate the pace of its growth, particularly with a focus on productivity, employment and investment efficiency. This would require in particular policies to promote competition, better coordination of public strategies and policies, and additional efforts to increase the quality of education and training systems throughout working life in order to strengthen the country's human capital". Thus, any policy of setting up and developing knowledge-intensive activities will inevitably require the development of human capital to build a workforce and skills capable of meeting the challenges of competitiveness.

The OECD's general statement (2017), in its report outlining the state of reforms adopted in Morocco, shows that despite a high level of spending, 4.7% of GDP and 23.6% of the general state budget, Morocco lags considerably, especially in terms of quality. Indeed, Morocco's budgetary effort has improved certain indicators. For example: the generalization of education, improvement in the enrolment rate (particularly at the primary level, which increased between 2011-12 and 2015-16 from 97.6% to 99.1%) and the number of years of schooling for the 15-year-old population (the rate according to CSEFRS data (2017) is set at 5.64 in 2014 compared to 5.64 in 2014 4.72 in 2010).

On the other hand, Morocco has recorded considerable levels of loss either internally (redoubling, dropping out of school...) or external (unemployment of graduates, lack of opportunity causing intense immigration of young graduates...). Moreover, the PNEA report (2016) confirms the situation of delay of the Moroccan education system through the analysis of the educational achievements of Moroccan students in the common core of secondary education; this indicator informs about a considerable delay in knowledge in particular languages and mathematics.

The OECD (2017) confirms, "9% of scientific students can be considered to perform in Arabic compared to 4% of literary students, and the majority of pupils in the Core are unable to react to what they read by making a sound judgment or expressing a point of view." This is also confirmed by the results estimated below the standards of Moroccan students in mathematics, science and reading on the TIMSS and PIRLS tests. With regard to vocational training, the situation is the same. Indeed, the FP system has made considerable advances in technical and practical knowledge acquired against a low performance illustrated, according to the report of the DFP, (2016), by a graduation rate or ratio between the number of graduates and the number of enrollees of 63% in the 2014-2015 training year. The study of the higher education system reveals a similar finding despite an increasing enrolment rate (16% in 2011 compared to 31.3% in 2016), OECD, (2017), which remains low and presents a problem of adequacy between the labor market and university courses provided. This is confirmed by the unemployment rate among higher education graduates set at 21.1%; this rate rises to 24.1% for university graduates.

#### **3-2-3- Information and communication technologies**

Morocco over the past ten years has undertaken several initiatives aimed at preparing its transformation into the digital age, a necessary condition for the development and dissemination of knowledge-oriented and knowledge-oriented sectors. This observation was confirmed by Nejjari, A. and Bakkali, I. (2017), who explain that several strategies have been implemented (Digital Morocco 2013 and Morocco Digital Plan 2020); "to make Morocco an attractive and efficient country in terms of Datacom infrastructure and IT business environments". The aim is to enable as many users as possible to access quickly and securely and to meet their expectations in terms of connectivity and mobility while supporting government actions on new information technology, communication and innovative crisis solutions (Remote training during the health containment period due to the COVID 19 pandemic). This has enabled ICT to invest in all spheres of everyday life, so the ANRT (2018; 2019) in its 2017 annual report explains that the Moroccan internet market continues its growth and recorded in 2017 a penetration rate of 63.67% with an increase compared to 2016 of 30.1%. In terms of equipment, 60.6% of households have a computer or tablet with an average annual growth rate during the period 2010-2018 of 7.5%.

#### IV. Conclusion

Morocco has considerable assets allowing it to claim a position of choice in the knowledge economy; this will be conditioned by the efficient exploitation of these assets, but also by the elimination of barriers to entry to this new economy. Indeed, despite the progress made in the fields of ICT, in the political and institutional and freedoms fields, Morocco is called upon to double its efforts to create an environment conducive to the development of knowledge-oriented activities in the light of other countries that have made this economy a means to the development and well-being of the population. Morocco is thus obliged to strengthen its capacity through the relaunch of the field of scientific research and innovation. The solution is the increase of the financial effort in favor of these areas, the increase in the number of qualified researchers, the development of its E-F system, the forging strong links between research institutions and companies and developing governance and evaluation of the field. This objective is also linked to the improvement of a number of indicators such as high literacy rates, better distribution of wealth, improved governance of public finances, levels of corruption, and improved infrastructure.

Our objective in the next steps is to present the impact of this new discipline on economic growth. Our methodology is conducted through an in-depth study of endogenous growth models, which form the basis of our conceptual modelling, a presentation of the state of this economy in the Moroccan context and finally the proposal of a model of testing variables based on an econometric study.

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