HUMAN CAPITAL MANAGEMENT IN A KNOWLEDGE ECONOMY: THE CASE OF SCIENTIFIC RESEARCH CENTERS IN ALGERIA

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Abstract:

This research aims to examine the existence of the human capital management through competencies and knowledge management approach in Scientific Research Centers within knowledge based economy. The study was applied to the case of Scientific Research Centers in Algeria, such as: (CREAD, CRSTRA, CDTA, CDER, CERIST, CRBt, CRAPC, CSC, CRSTDLA, and CRASC). The data of the study was collected through interviews and a questionnaire during 2011-2012, and it was analyzed using SPSS 18.0 to determine the interaction between the various factors. The findings broadly support the hypothesis and suggest a number of insights for future studies.

Key words: Human Capital Management, Knowledge Management, Competencies Management, Scientific Research Centers in Algeria.

Classification Jel : O15, M1, O3**.**

Introduction:

Nowadays, we are moving towards a knowledge economy where intangibles assets investments are seen as essential elements to value creation in companies. The emergence of knowledge economy is among the forces that are resulting in transforming Human Resources (HR) function. There is a growing consensus that intellectual capital, more specifically human capital (HC) is critical to an organization's success, and that the HR focus must be more strategic in the new knowledge-based economy era (Yusliza & Hazman, 2008).

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The concept of intellectual capital is not new. In fact the economist Nassau mentions "*intellectual capital*" as an important factor of production in his book, published more than 150 years ago in 1836. Therefore, Intellectual capital is an intangible asset that has supplanted industrial machinery, and natural resources, and is today considered as one of the most valuable factors for the creation of wealth, being at the same time a source and a final product. The management of intellectual resources has thus become the most important task of business, governments and people in contemporary society (Sarrocco)[1].

There is a multi-faceted description of intellectual capital as proposed by intellectual capital theorists. A study by Sveiby (1987), for example, proposed that knowledge-based assets could be found in three places: the competencies of organization members, its internal structure, such as: patents, models, computer and administrative assets, and external structure such as brands, reputation and relationships with customers (Rosmah et al, 2008). As a general perception, intellectual capital has three components: human capital, structural capital and relational capital (Suciu, 2000):

- *Human Capital*: comprises: the competence, skills, and intellectual ability of the individual employees;
- *Structural Capital* (organizational capital) includes: processes, systems, structures, brands, intellectual property, and other intangibles that are owned by the firm, but do not appear on its balance sheet;
- *Relational Capital* (customer capital): represents all the valuable relationships with customers, suppliers and other relevant stakeholders.

The term "*human capital*" was first introduced by Theodore Schultz, Nobel Prize winner. In 1963, Schultz wrote about the necessity of *investments in education* in order to increase the agricultural productivity in the USA. In 1975, Gary Becker developed *a theory of human capital*, which stated that the level of education and the experience of a person add up as determinant factors of their income (Suciu, 2000).

Human capital (HC) embodies the knowledge, talent, judgment and experience of employees. Bontis (1999) argued that HC is important

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[1] http://www.itu.int/vision [Accessed 16th September 2012]).

because it is a source of innovation and strategic renewal. In addition, he argued that HC is the profit lever of the knowledge-driven economy. A knowledge-driven economy is an economy where generation and exploitation of knowledge plays a predominant path in the process of wealth creation (Yusliza and Hazman, 2008).

The human capital has been emphasized as one of the key success factors of a company. It can be assumed that most successful companies have organized or at least they should have organized their management of the human capital systematically. The management of human capital can be put into practice by applying competence management and knowledge management practices. Numerous studies of competence and knowledge management have been carried out but the practices of this area are still not very well known (Hannula et al, 2003).

This research aims to examine the main question: How can human capital management be improved in research Centers within a knowledge based economy? More specifically, we suggest that human capital management depends on its competencies management and knowledge management.

To answer this problematic, we start our research with an introduction that highlights the importance of "human capital management within a knowledge based economy", the first part of our paper provides a theoretical background of different managerial concepts including knowledge economy, human capital management, competence management and knowledge management, while the second part of this paper illustrates the methodological procedures followed in this study.

This paper highlights the case of ten Scientific Research Centers in Algeria (i.e. CDER, CERIST, CDTA, CSC, CRAPC, CRSTDLA, CREAD, CRASC, CRSTRA, and CRBT) mainly for the reason that they represent learning organizations within a knowledge economy, and because they push their researchers to continuous learning and innovation processes in ways that help solving companies' problems through providing new ideas, products, and programs and so on.

1. Literature review

1.1. Knowledge economy (KE):

If the industrial economy ran on coal and iron ore, the fuel of today's economy is knowledge. Technologies have always been underpinned by knowledge, but an economy run on knowledge is characterized by a critical role of information and communication technology (ICT), a high proportion of knowledge-intensive activity, and intangible capital that amounts to more than tangible capital in the economy's capital stock, (Stam and Garnsey)[2].

The emergence of the knowledge economy is not confined to high-technology and ICT services. It has spread across all sectors of market economies since the 1970s. Wealth creation increasingly depends on the generation and exploitation of knowledge involving not only science and technology, but also knowledge of practice required to create economic value (Stam & Garnsey),

In figure N° 1, Lopes et al (2005) have identified the basic pillars of the knowledge economy (KE) in the technological innovation pillar, the science and education pillar, and other pillars: cultural, citizenship and the use of information and communication technologies. We accept that knowledge can be codified and then stored in a computerized system to be made available on demand. So the main purpose of knowledge management is the acquisition, capture, transformation, access, diffusion and re(use) of the knowledge throughout the individuals and communities (Lopes et al, 2005). Those activities can be more efficient, depending on the context that allows and facilitates their development.

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[2] http://www.dur.ac.uk/resources/dbs
/faculty/centre_entrepreneurship/publications/ResearchPaper018.pdf
[Accessed 16th September 2012]).

Figure 01**: The basic pillars of the knowledge economy the knowledge economy pillars**
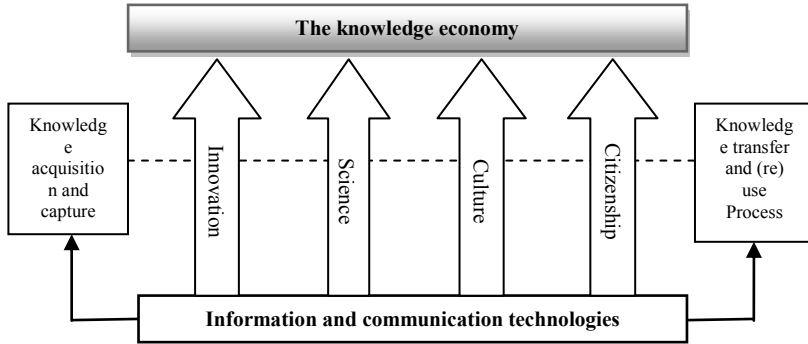
Source: Ilídio Lopes, Maria do Rosário Martins and Miguel Nunes (2005), p 133.

Knowledge creation, use, sharing and retention have always been important. What is new is the significant shift towards a systematic, and strategic approach to managing the primary assets of the knowledge economy: people, knowledge processes, and knowledge products. Globally, knowledge has become the most important factor in economic development and knowledge assets (intellectual capital, human capital…etc) are considered essential for economic growth, competitive advantage, human development and quality of human life (Whicker and Andrews, 2004).

1.2. Human capital:

In a knowledge economy, people are considered as revenue creators rather than costs. Knowledge of people's competence is source of wealth creation. Human capital is valuable to the extent that it contributes to a firm's competitive advantage by improving efficiency and effectiveness, exploiting opportunities or neutralizing threat. They are the only assets that appreciate with use. Human capital is the employees' ability to do things that ultimately make the company works and succeeds (Choudhury, Mishra, 2010).

For Medard et al. (2012), Human capital "*is the stock of competencies, knowledge and personality attributes embodied in the ability to perform labor, so as to produce economic value*". Human capital increases through education and experience. Many early economic theories refer to it simply as: workforce, and consider it to

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be a resource homogeneous, and easily interchangeable. Other conceptions of this labor dispense with these assumptions.

The use of the term in the modern neoclassical economic literature dates back to Mincer's article in 1958. Then Schultz has also contributed to the development of the subject matter. The best-known application of the idea of "human capital" in economics is that of Mincer and Becker of the Chicago School of Economics. Becker's book published in 1964 became a standard reference for many years. In this view, human capital is similar to "*physical means of production*", e.g., factories and machines: one can invest in human capital (via education, training) and one's outputs depend partly on the rate of return on the human capital one owns, thus human capital is a means of production, into which additional investment yields additional output. Human capital is substitutable, but not transferable like land, labor, or fixed capital. Modern growth theory sees human capital as an important growth factor (Medard, Djomo, and Sikod 2012).

For over three centuries, economists have been interested in valuing the productive capacity of the workers in an economy. The human capital can be defined as "*the stock of knowledge, skills, competencies, and abilities embodied in individuals that determine their level of productivity. In principle, it includes innate abilities, and skills acquired through education, training and experience*" (Medard, Djomo, and Sikod, 2012). On a macro level, it is also common to measure the economy's human capital by the rates of enrolment in elementary and secondary schools and in post-secondary institutions. It is assumed that high enrolment rates in education, and training institutions indicate that more people are accumulating human capital, and that the workforce, as a whole, is becoming more productive. Indeed, countries with high enrollment rates in education and training institutions tend to enjoy higher productivity, higher living standards, and faster economic growth (Medard, Djomo, and Sikod, 2012).

So most of authors [Bontis & Fitz-enz, 2002; Davenport, Pmsak, & Wilson, 2003; Edmonson, 1999; Edvinsson & Malone, 1997; LA.D.E.-CI.C, 2003; Kaplan & Norton, 1999; Roos et al., 1997] agreed that the human capital can be defined as "*the value of the knowledge and talent which is embodied in people who make up the organization, representing its know-how, the capacities, the*

knowledge, talent, competence, attitude, intellectual ability, creativity, and others" (Helena et al, 2010).

1.3. **Human capital management** (HCM)

We shift to the term "human capital" because HC signals a focus that is broader than the human resources HR function and operational processes. HC is intended to capture all efforts addressing people issues, not merely to serve as a new name for HR. HCM responds to the need of creating smart organizations by hiring the right people, giving them the right knowledge and providing them with ways to share that knowledge in order to benefit the entire organization (Afiouni, 2009).

The increasing acceptance of the HCM concept is helping to break down the boardroom barriers. It encapsulates an organization-wide business-development goal, rather than a limited human-resources function. HCM is all about ensuring that the enormous potentials provided by people are aligned with the mission and strategic objectives of the business, to maximize their value on behalf of the stakeholders (Finn, 2003). Human Capital is not merely a new name for HR. We strongly believe that it is the beginning of a new era for HRM, an era where HR is more strategic, more business oriented, and more flexible as shown in our HC definition (Afiouni, 2009).

"Managing people based on their human capital will allow an organization to optimize knowledge creation, whether of new product, ideas and services or of improvements in business processes "Human capital theorists have typically argued that organizations can increase their human capital by internally developing the knowledge and skills of their current employees, and by attracting individuals with high knowledge and skill levels from the external labour market" (Choudhury, Mishra, 2010).

. *T*hat is, organizations can try to make and buy human capital. Human capital grows in two ways; when the organization uses more of what people know and when more people know more of what is useful to the organization. According to resource based view of the firm, performance differences across the firm can be attributed to the variance in firm's resources and capabilities. Resources that are valuable, unique and difficult to imitate can provide the basis for firm's competitive advantages. *"Organization exists for a purpose and is a deliberate arrangement of human and other resources with the*

aim of delivering needs, satisfying services and products as effectively and efficiently as possible" (Choudhury, Mishra, 2010).

The resource-based view developed by the seminal work of Barney (1991) "*posits that organizational resources and capabilities that are rare, valuable, non-substitutable, and imperfectly imitable form the basis for a firm's sustained competitive advantage*". "*Among various types of resources, the resource-based-view accredits human capital as the most important type of resources a firm has*" (Pfeffer, 1994; Wright, McMahan, and McWilliams, 1994). Human capital, in particular a high level of competency and commitment, is a unique resource that creates performance differentials. This is especially so for those firms operating in complex and dynamic competitive environments where the capability to rapidly acquire and assimilate new market and technological capabilities is the key to enduring advantage over competitors. (Afiouni, 2009).

Knowledge is created by individuals. An organization cannot create knowledge on its own without individuals. As individuals learn, they increase their human capital and create knowledge that potentially forms a foundation for organizational level learning and knowledge accumulation. Knowledge stocks provide a foundation for understanding the role of human capital as a potential source of firm's core competencies (Choudhury, Mishra, 2010). Also according to Penrose a firm may achieve rents not because it has better resources, but rather the firm's distinctive competence involves making better use of its resources (Mahoney and Pandian, 1992).

Nalbantian & al (2004) emphasize the purposeful measurement aspect of HCM. They define human capital as: "*the stock of accumulated knowledge, skills, experience, creativity and other relevant workforce attributes"* and suggest that HCM involves *"putting into place the metrics to measure the value of these attributes and using that knowledge to effectively manage the organization*" (Baron, Armstrong, 2007).

HCM is sometimes defined more broadly without the emphasis on measurement. Chatzkel (2004) states that: "*HCM is an integrated effort to manage and develop human capabilities to achieve significantly higher levels of performance*". And Kearns (2005) describes HCM as: "*The total development of human potential expressed as organizational value*". He believes that "*HCM is about creating value through people*" and that it is "*a people development*

philosophy, but the only development that means anything is that which is translated into value" (Baron, Armstrong, 2007).

Based on what we have analyzed the human capital management HCM can be put into practice by applying competence management and knowledge management practices. Numerous studies of competence and knowledge management have been carried out, but the practices of this area are still not very well known (Hannula et al, 2003). We suggest that human capital management depends on its competencies management and knowledge management. Also without knowing the best practices related to competence and knowledge management there is a possibility that the research of this area will stay too theoretical, so that it does not deliver true benefits for Scientific Research Centers.

1.3.1. Competence management CM:

According to Hoge, Tondora and Marelli *"A competency is a measurable human capability that is required for effective performance. A competency may be comprised of knowledge, a single skill or ability, a personal characteristic, or a cluster of two or more of these attributes. Competencies are the building blocks of work performance. The performance of most tasks requires the simultaneous or sequenced demonstration of multiple competencies (Marrelli et al, 2005)"*

"Knowledge is awareness, information, or understanding about facts, rules, principles, guidelines, concepts, theories, or processes needed to successfully perform a task (Marrelli, 2001; Mirabile, 1997). The knowledge may be concrete, specific, and easily measurable, or more complex, abstract, and difficult to assess (Lucia & Lepsinger, 1999). Knowledge is acquired through learning and experience" …"A skill is a capacity to perform mental or physical tasks with a specified outcome (Marrelli, 1998)". Similar to knowledge, skills can range from highly concrete and easily identifiable tasks, such as filing documents alphabetically, to those that are less tangible and more abstract, such as managing a quality improvement project"[3].

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[3] http://www.bbs.ca.gov/pdf/mhsa/resource/workforce/
behavioral_health_wkforce_competencies_fundamentals.pdf

Competence management can be seen as a process, which supports the accomplishment of the goals derived from the strategy. To attain the business goals a company must recognize its core competencies. Core competencies are issues that are critical and unique from the perspective of the business and those are hard to copy. In competence management the main goal is to fulfill the strategy driven core competencies by the help of individual level competencies. "*According to Sydanmaalakka (2000) competence management is a process, which starts from organization's vision, strategy and goals. The process continues by defining core competencies and by sharing the core competencies to competencies, which will be concretized in the different levels of an organization"* (Hannula et al, 2003).

1.3.2. Knowledge management KM:

Knowledge management also is usually seen as a process, it can be defined as the explicit and systematic management of vital knowledge and its associated processes of creating, gathering, organizing, diffusion, use and exploitation. It requires turning personal knowledge into corporate knowledge that can be widely shared throughout an organization and appropriately applied (Suresh et al)[4],

In KM, *the goal is to administer and manage knowledge, skills, competencies and communication, and to maximize organization's performance, which will be achieved by creating and sharing knowledge* (Hannula et al, 2003). *Ultimately, the goal of knowledge management is to leverage the intellectual capital that is currently resident in the organization, and to convert that knowledge into sustainable competitive advantage through increased business performance (Bontis, Fitz-enz, 2002).*

KM, "from the HRM perspective, is more than just the management of information systems, more than just the management of the interface between people and those systems. "Effective KM facilitates the acquisition of knowledge by individuals. It encourages them to apply their knowledge for the benefit of the organization, so that competitive advantage and service excellence are achieved" (Christopher Harman, 2007).

Both in CM and KM processes are in the central position according to individuals and their management. According to Huber (1991)

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[4] *www.wbiconpro.com/409-Suresh.pdf.* [Accessed 25th October 2012].).

"*organization's knowledge and competencies are mainly based on individuals. Knowledge is internalized information, which has a meaning to an individual*". Competence consists of abilities to apply knowledge on practical problems. Roos et al (1997) "*view strengthens the thigh connection of competence and knowledge because according to them competence consists of knowledge and skills, and knowledge and competence are mutually connected cognitive processes, it is reasonable to study competence management and knowledge management together*" (Hannula et al, 2003).

We have studied the human capital management and its importance in KE (Knowledge economy) of firms. Also we have discussed how it depends on particular HCM practices, the Competence Management and Knowledge Management could be this particular practices. The HCM with its particular practices (CM+KM) could direct researchers or Scientific Research Centers to the innovativeness or the excellence. In our study, we focus on CM and KM as fundamental practices of HCM.

H_0: HCM can be improved in Research Centers within knowledge based economy, and it depends on CM and KM.
H_1: HCM is positively related with the CM in the Center.
H_2: HCM is positively related with the KM in the Center.

Figure2: **The research model**
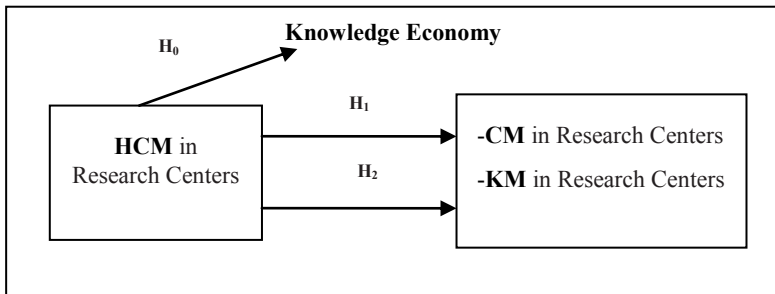
Source: proposed by the Author based on Literature review

In our case, Research Centers will search for effectiveness in applying the HCM with its particular practices in order to develop valuable and unique knowledge that favors excellence in performance, thus we propose the following hypotheses:

2. Data collection (methodology)

The study was applied on the case of Scientific Research Centers in Algeria which are: CDER, CERIST, CDTA, CSC, CRAPC, CRSTDLA, CREAD, CRASC, CRSTRA, and CRBt (Table 01). Targeted population is made of researchers. The criteria for selecting the population were: (**1**) the research centers should be belonging to the Minister of Higher Education and Scientific Research[5], (**2**) centers have at least 30 researchers, (**3**) Researchers of Centers represent a stock of knowledge and competencies what we can call it human capital, (**4**) the aim of centers is to solve companies' problems through providing new ideas, products, and programs…etc, (**5**) centers as learning organizations push their researchers to a continuous learning and innovation.

Our research uses interviews with managers and researchers (women/ men) of the centers. These interviews were focused on themes; such as: the compensation of researchers, evaluation, motivation, promotion, skills development through training and learning, CM, KM, and HCM.

This study adopted five-point Likert scale (table 02). Based on the literature, twenty-nine-items questionnaires were developed for HCM divided two parts as follows: 19 for CM (Q1-Q19) and 10 for KM (Q20-Q29).

Our final population was made of 10 centers with a total of 500 researchers. Regarding the sampling method, the study used non-probability convenience sample. A convenience sample of 250 researchers was selected through e-mail and postal questionnaires during 2011 to 2012.A total of 101 questionnaires were completed and returned, with an entire response rate of 40 percent (40%). Data gathered through questionnaires were analyzed using SPSS 18.0 to determine the relationship between the various factors.

3. Data Analysis

3.1. Validity and Reliability test

To verify the dimensionality and reliability of each construct, purification processes including validity and reliability analysis are conducted in this study. Through reliability test, this study found their

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[5] http://www.mesrs.dz.

Cronbach's α was more than 0.65, which means that these questionnaires have enough reliability (table 03). To validate the measurement model, content and construct validity were assessed. The content validity was established by ensuring consistency between the measurement items and the extant literature (Acosta, Cerdan, 2008). The result of the validity is shown in (table 04). The results indicate that each variable had been significant loading (the most significant loadings ranged from 0.708 to 0.954 on their path loadings at the level of 0.01).

Table 03: **Cronbach's Alpha for scales**

The variables	Cronbach's Alpha
Competence Management CM	0.840
Knowledge Management KM	0.789
Human Capital Management HCM	0.844

Source: Data established based on the SPSS 18.0.

Table 04: **Test of construct Validity: Person**

The variables	Sig. (bilatérale)	Correlation of item-to-total
Competence Management CM	.000	0.954[**]
Knowledge Management KM	.000	0.932[**]
Human Capital Management HCM	.000	0.708[**]

**correlation is significant at the 0.01 level
Source: Data established based on the SPSS 18.0.

3.2. The personal characteristics of researchers' Centers:

The (table 05) shows the personal characteristics of researchers according to: Gender, age, diploma, grade, experience, and income.

The data from this table in addition to past interviews allow us to draw the following conclusions:

- Women (41.6%) and men (58.4%) are represented in a balanced way in the centers.
- The majority of the population is young researchers (69.4%). 65.3% had a post-graduate degree (magister) and 16.8% hold a PhD, Engineers represent 17.8%.
- More than 69.3% are basic jobs and basic grades, which are generally filled by young graduates of engineering degree holders and Magister.

- The experience plays a very important role in the capitalization of tacit knowledge (KM), 46% of researchers have an experience ranging from one year to six years.
- It is clear that the centers have a good potential capable of achieving the innovation process. All parameters indicate positive effects on human capital available in the centers, except the compensation as pointed out by researchers.

3.3. Hypothesis Testing

Hypothesis testing were verified according to the statistical tools: *(Normality, Mean, and simple regression).*

3.3.1. Normality analysis

Before running the model we followed and checked the data for missing data and normality. The normality occurs when the shape of data distribution for the variables varies considerably from the normal distribution. The reported values of skewness and kurtousis would indicate, if there were normality and outlier problems that may influence the covariance matrix and the results in structural equation modeling. The skewness index ranges from -0.262 to 0.028 and kurtosis index ranges from -0.898 to -0.473 (table 06). Following the recommendation of many researchers, the skewness and kurtosis indices should not exceed an absolute value of 1 and 3 (Awwad and Agti, 2011). Respectively, data in this study are regarded as normal.

Table 06**: Assessment of Normality**

Variable	Skewness	Kurtosis
Competence Management CM	0.028	-0.898
Knowledge Management KM	-0.262	-0.473
Human Capital Management HCM	-0.045	-0.851

Source: Data established based on the SPSS 18.0.

3.3.2. Test of convergence of views of respondents

According to the tables (07 and 08) the mean of the most of variables is located between 2.841 and 2.994, than the answers of the respondents place themselves in the third box (From 2.60 to 3.39) on the Likert scale. This leads to the conclusion that there is an average level of HCM and CM in centers, except the KM is located in the

fourth box (From 3.40 to 4.19) on the Likert scale, this means that there is a good level of KM in centers.

According to the (table 07), the respondents disagree about the questions (Q3, Q5, Q6, Q7, Q10 and Q18) because they think that the centers do not try to discover their competencies and skills; also the centers do not provide them with a sufficient training inside or outside the country; most centers do not have new methods of developing competencies; the researchers do not agree about the standards of evaluation of their competencies and they are not satisfied with the moral motivation (not financial) in centers.

According to the (table 08), the respondents disagree about the question (Q21) because they observe that the centers do not realize how important their tacit knowledge, and the value of transforming it to explicit knowledge to serve the centers.

3.4. Relationships among HCM, CM and KM of Centers:

According to the simple regression analysis Pearson test, we found that:

- HCM is positively correlated with the CM in the Centers (0.954).
- HCM is positively correlated with the KM in the Centers (0.932).

Therefore, it is clear that relationships do exist between HCM, CM and KM. This finding provides sufficient support of the hypotheses: H_0, H_1 and H_2.

Table 09: **The simple regression analysis: Pearson test**

The variables	Human Capital Management HCM
Competence Management CM	0.954[**]
Knowledge Management KM	0.932[**]

**correlation is significant at the 0.01 level
Source: Data established based on the SPSS 18.0.

4. Research results:

This study indicates that:

- The centers have good potentials. All parameters indicate positive effects on human capital that is available in the

> Centers, except the compensation as pointed out by researchers.

- Hypotheses testing were verified according to the statistical tools: (Normality, Mean, and simple regression) which provides sufficient support of H_0, H_1 and H_2;

H_0: HCM can be improved in research centers within knowledge based economy, and it depends on CM and KM (is proved).
H_1: HCM is positively correlated with the CM in the centers (is proved).
H_2: HCM is positively correlated with the KM in the centers (is proved).

- There is an average level of HCM and CM in centers, and a good level of KM in centers.

- The researchers think that centers do not provide them with a sufficient training inside or outside the country; most of centers do not have a new methods of developing competencies; the researchers do not agree about the standards of evaluation of their competencies, and they are not satisfied with the moral motivation (not financial) of the centers. Also the centers do not realize how important their tacit knowledge, and the value of transforming it to explicit knowledge to serve the centers.

5. The contribution of HCM in research centers within knowledge economy:

According to the literature, HCM is one of the main sources of performance and excellence. If Centers develop its management based on valuable human capital; such as: valuable and unique knowledge and competencies, they will lead to higher levels of performance (and excellence). These employees (researchers) are also the most flexible in acquiring new skills, which enhance the firm's innovative performance.

Centers that offer new researches; such as: (products, programs, invention, patents, methods, procedures,…etc) through the good management of their HC will adapt to the needs and the wants of the Algerian economic companies, and they will have a better position to obtain higher performance and sustainable excellence.

6. Conclusion and future research:

Today, knowledge economy depends on intangible assets especially human capital; Moreover, HCM responds to the need of creating smart organizations by hiring the right people, giving them the right knowledge, and providing them with ways to share that knowledge in order to benefit the entire organization (Afiouni, 2009). *HCM can be improved in scientific research centers within knowledge economy. More specifically, HCM depends on its competencies management and knowledge management which have also an important role in the knowledge economy.*

We suggest that the scientific research centers should establish strong programs of incentives for researchers which can motivate their activities of invention and innovation. So far as comprehensive training practices are concerned, since the centers understudy are knowledge based investments, intellectual capital, especially human capital are the major asset of the centers, these latter should continuously invest on comprehensive training practices like: seminars, conferences, coaching, counseling and mentoring activities for researchers development.

If centers develop its management based on valuable human capital; such as: valuable and unique knowledge and competencies, they will lead to higher levels of performance (excellence). These employees (researchers) are also the most flexible in acquiring new skills, which enhance the firm's innovative performance. Centers that offer new researches; such as: (products, programs, invention, patents, methods, and procedures…etc) through the good management of their HC, will adapted to the needs and the wants of the Algerian economic companies, and they will have a better position to obtain higher performance and sustainable excellence.

While the contribution of the present study is significant, it has some aspects which can be addressed in future research. First, the sample used was from 10 centers. It may be possible that the findings could be extrapolated to other centers; however, in future research; a sampling frame that combines researchers from different centers could be bigger. Second, the effect of HCM and its practices (CM and KM) on the excellence performance can be studied in the future. Third, this study can be applied on economic firms also.

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APPENDICES

Table 01: **The Scientific Research Centers in Algeria**

N	INITIALS	denomination
1	CDER	Centre de Développement des énergies renouvelables (Alger)
		Centre for Renewable Energy Development (Algiers)
2	CERIST	Centre de Recherche sur l'Information Scientifique et Technique (Alger)
		Research Centre for Scientific and Technical Information
3	CDTAA	Centre de Développement des Technologies Avancées (Alger)
		Centre for Development of Advanced Technologies
4	CSC	Centre de Recherche Scientifique et Technique en Soudage et Contrôle (Alger)
		Center for Scientific Research and Technology in Welding and Control
5	CRAPC	Centre de Recherche Scientifique et Technique en Analyses Physico – Chimiques (Alger)
		Center for Scientific and Technical Research in Physical Analysis - Chemical
6	CRSTDLA	Centre de Recherche Scientifique et Technique sur le Développement de la Langue Arabe (Alger)
		Center for Scientific and Technical Research on the Development of Arabic Language
7	CREAD	Centre de Recherche en Economie Appliquée pour le développement (Alger)
		Centre for Research in Applied Economics Development
8	CRASC	Centre de Recherche en Anthropologie Sociale et Culturelle (Oran)
		Centre for Research in Social and Cultural Anthropology
9	CRSTRA	Centre de Recherche Scientifique et Technique sur les Régions Arides (Biskra)
		Center for Scientific and Technical Research in the Dry Areas
10	CRBt	Centre de Recherche en Biotechnologie (Constantine)
		Centre for Research in Biotechnology

Source: Data established based on the web site: http://www.mesrs.dz

Table 02**: Five-point Likert scale**

weighted mean	Level
From 1.00 to 1.79	Completely disagree
From 1.80 to 2.59	Disagree
From 2.60 to 3.39	Neutral
From 3.40 to 4.19	Agree
From 4.25 to 5.00	Completely agree

Source:available at:
http://www.clemson.edu/Centersinstitutes/tourism/documents/sample-scales.pdf

Table 05: **personal characteristics of researchers of Centers according to: Gender, age, diploma, grade, experience, income.**

Measure	Frequency	percent
Gender		
male	59	58,4
Female	42	41,6
Age (year)		
24-29	23	22,8
30-35	25	24,8
36-41	22	21,8
42-47	10	9,9
48-53	10	9,9
54-59	11	10,9
Diploma		
Engineer	18	17,8
Magister	66	65,3
PhD	17	16,8
Grade		
« Chargé d'étude »	18	17.8
« Attaché de recherche »	52	51.5
« Chargé de recherche »	15	14.9
« Maître de recherche »	13	12.9
« Directeur de recherche »	3	3
Experience (an)		
1-6	46	45,5
7-12	26	25,7
13-18	11	10,9
19-24	8	7,9
25-30	10	9,9
income (dinar)		
20000- 40000	13	12,9
40001- 60000	41	40,6
60001- 80000	17	16,8
80001- 100000	18	17,8
100001- 120000	8	7,9
120001- 140000	1	1,0
140001- et plus	3	3,0
Total	101	100 %

Source: Data established based on the SPSS 18.0.

Table 07: **The convergence of views of respondents (CM)**

		Degree of agreement					Mean	Standard Deviation	Result
		Completely Agree	Agree	Neutral	Disagree	Completely disagree			
Q1	Frequency	20	17	24	26	14	2,9703	1,33758	Neutral
	Percent	19.8	16.8	23.8	25.7	13.9			
Q2	Frequency	34	14	23	18	12	2,6040	1,41477	Neutral
	Percent	33.7	13.9	22.8	17.8	11.9			
Q3	Frequency	28	27	15	22	9	2,5743	1,33676	Disagree
	Percent	27.7	26.7	14.9	21.8	8.9			
Q4	Frequency	23	18	20	22	18	2,9406	1,42704	Neutral
	Percent	22.8	17.8	19.8	21.8	17.8			
Q5	Frequency	38	34	4	21	4	2,1980	1,25714	Disagree
	Percent	37.6	33.7	4	20.8	4			
Q6	Frequency	40	27	8	18	8	2,2772	1,35734	Disagree
	Percent	39.6	26.7	7.9	17.8	7.9			
Q7	Frequency	64	12	5	11	9	1,9010	1,38928	Disagree
	Percent	63.4	11.9	5	10.9	8.9			
Q8	Frequency	22	16	21	26	16	2,9802	1,39270	Neutral
	Percent	21.8	15.8	20.8	25.7	15.8			
Q9	Frequency	24	19	1	30	27	3,1683	1,58158	Neutral
	Percent	23.8	18.8	1	29.7	26.7			
Q10	Frequency	30	23	21	16	11	2,5545	1,35259	Disagree
	Percent	29.7	22.8	20.8	15.8	10.9			
Q11	Frequency	26	17	18	20	20	2,9109	1,48391	Neutral
	Percent	25.7	16.8	17.8	19.8	19.8			
Q12	Frequency	29	15	20	19	18	2,8218	1,47916	Neutral
	Percent	28.7	14.9	19.8	18.8	17.8			
Q13	Frequency	26	26	20	19	10	2,6139	1,31887	Neutral
	Percent	25.7	25.7	19.8	18.8	9.9			

Q14	Frequency	8	10	8	28	53	4,0693	1,29041	Agree
	Percent	7.9	9.9	2	27.7	52.5			
Q15	Frequency	22	15	22	26	16	2,9901	1,38921	Neutral
	Percent	21.8	14.9	21.8	25.7	15.8			
Q16	Frequency	24	12	35	13	17	2,8713	1,36867	Neutral
	Percent	23.8	11.9	34.7	12.9	16.8			
Q17	Frequency	11	8	18	4	60	3,9307	1,44400	Agree
	Percent	10.9	7.9	17.8	4	59.4			
Q18	Frequency	38	24	4	20	15	2,5050	1,52068	Disagree
	Percent	37.6	23.8	4	19.8	14.9			
Q19	Frequency	9	6	5	12	69	4,2475	1,31458	Completely agree
	Percent	8.9	5.9	5	11.9	68.3			
CM	Frequency	516	340	292	371	406	2,8915	,70649	Neutral
	Percent	25.45	17.71	14.97	19.32	21.52			

Source: established by the author based on SPSS results.