The impact of Human Capital Management on the Innovativeness of research Center:
The Case of Scientific Research Centers in Algeria

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Abstract:

Nowadays, we are moving towards a knowledge economy where the competitiveness of firms is mainly based on their capacity of **innovation**, and on the management of their intellectual capital. Moreover, it is widely accepted that firm's innovation capabilities are more closely linked to their intellectual capital than to their fixed assets. The importance of intellectual capital for innovation has attracted researchers interested in determining its elements and the process by which enhances the innovative capabilities and performance of firms (Carmen Cabello-Medina et al, 2011).

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).

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). Moreover, Subramaniam and Youndt (2005) found that the combination of human and social capital positively affected firms' innovative capabilities (T.T. Selvarajan et al, 2007).

This research aims at examining the impact of human capital management on the innovativeness of Scientific Research Centers through competencies and knowledge

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management approach. 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 2011-2013, 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 about future studies.

Key words: Human Capital Management **O_{15}**, Knowledge Management **M_1**, Competencies Management **O_{15}**, innovativeness, Scientific Research Centers in Algeria **O_3**.

JEL Classifications: O15, M1, O3.

1. Introduction:

Nowadays, we are moving towards a knowledge economy where intangibles assets investments are seen as essential elements to value creation in companies, and the emergence of knowledge economy are 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).

In this economy the competitiveness of firms is mainly based on their capacity of **innovation**, and on the management of their intellectual capital. Moreover, it is widely accepted that firm's innovation capabilities are more closely linked to their intellectual capital than to their fixed assets. The importance of intellectual capital for innovation has attracted researchers interested in determining its elements and the process by which enhances the innovative capabilities and performance of firms (Carmen Cabello-Medina et al, 2011).

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

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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.

As we said before researchers have been made recent efforts to link intellectual capital and innovation, some argue that intellectual capital is an innovation input, others considerer that innovation is a result of the intellectual capital, or that the different innovative capacities vary on the type of knowledge needed (Carmen Cabello-Medina et al, 2011).

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 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). Moreover, Subramaniam and Youndt (2005) found that the combination of human and social capital positively affected firms' innovative capabilities (T.T. Selvarajan et al, 2007).

This research aims to examine the main question: Is human capital management important in enhancing innovativeness of the research Center? 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, knowledge management and innovation, 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…etc.

2. Literature review

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

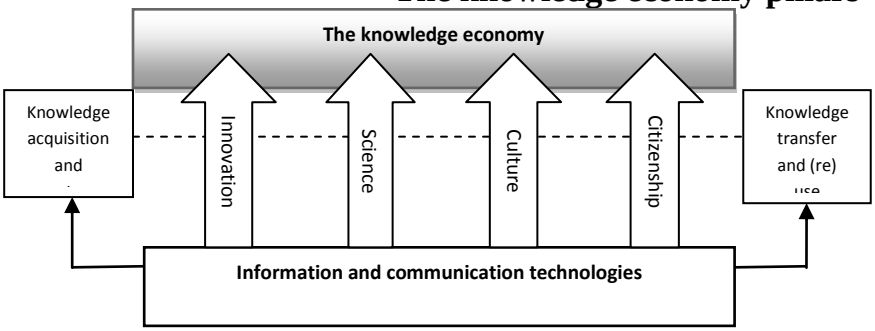
The emergence of the knowledge economy is not confined to high-technology and ICT services; it has spread across all sectors of market economies since the 1970s. Wealth creation increasingly depends on the generation and exploitation of knowledge involving not only science and technology, but also knowledge of practice required to create economic value (Stam & Garnsey, http://www.dur.ac.uk/resources/dbs//faculty/centre_entrepreneurship/publications/ResearchPaper018.pdf [Accessed 16th September 2012]).

In figure 01, 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.

Fig. 1: The basic pillars of the knowledge economy

Figure 01:
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).

2.2. 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 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).

2.3. **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 (Choudhury, Mishra, 2010).

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. That 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.*

2.3.1. Competence management CM:

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.

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).

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

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) 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).

Also to talk about the effectiveness of KM in achieving innovation we must talk about **knowledge creating process** which leads us to **Nonaka and Takeuchi Model** (fig. 2).

First, there are two types of knowledge: tacit knowledge and explicit knowledge: **-Tacit knowledge**: Here the knowledge is created from internally of an individual that means getting the knowledge from individual's experiences; and it cannot be shown or written. **-Explicit knowledge**: Here the knowledge is created from the external sources; and it can be shown in form of paper or records…etc.

The tacit knowledge held by the individuals is converted by their spiral of knowledge through these processes: 1.Socialization 2. Externalization 3. Combination and 4.Internalization. (available at : http://rahulgunti.blogspot.com/2009/02/nonakas-seci-model.html).

Socialization means sharing of knowledge (tacit to tacit) through "face to face" communication.

e.i: to develop a project in an organization, people use their own lifetime experiences to build up the project.

Externalization, it's an "Articulating tacit knowledge through dialogue and reflection".(Nonaka & Takeuchi) e.i: In an organization, the knowledge of an individual's tacit knowledge (experience) is taken by other members, that means here the tacit knowledge is converted to explicit knowledge (tacit to explicit).

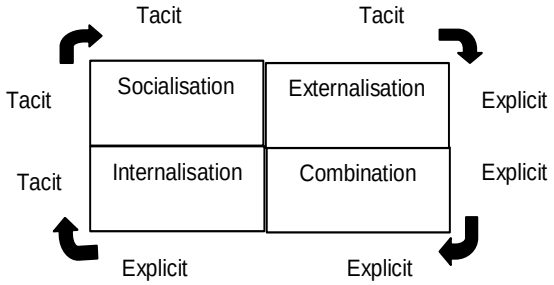
Combination, It's a combination of various elements of explicit knowledge.

e.i: Getting the knowedge from various explicit knowledge experiences of an individual and applying systemize them into other organizations (explicit to explicit).

Interanalization, it's a "Learning and acquiring new tacit knowledge in practice" (Nonaka & Takeuchi). e.i: Getting the explicit knowledge by an individual through reading, listening, and observing which will be converted into tacit knowledge.

Fig .2:

The SECI Process (Nonaka and Takeuchi)



Source: *Martin Wickes, Annette Leslie, Fiona Lettice, available online.*

Both in CM and KM processes in the central position are individuals and their management. According to Huber (1991) organization's knowledge and competencies is 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. Because knowledge and competence are mutually connected cognitive processes, it is reasonable to study competence management and knowledge management together (Mika Hannula et al, 2003). So the HCM can be put into practice by applying CM and KM practices.

2.4. Innovativeness

Innovation may be defined as act of propagating an idea and transforming it into a new product, service, or business model that can be useful to customers. There are two important segments of innovation, namely: product innovation and process innovation. It should be noted that innovation can also be pursued radically (i.e, sudden change of modus operandi) and incrementally (i.e, incremental with step-by-step improvement) (Fawzy Soliman, 2011).

Innovativeness is a kind of recognition of changing attitude or innovation (Feaster, 1968). Tidd, Bessant, and Pavitt (2001) also conveyed **that innovation** is not only good thinking, it needs to be realized by actual action. Therefore, innovation is comprised of original concepts, innovativeness of its members, and real products or services.

Innovation separates into two parts. One part is the "proactive innovation," and the other part is the "reactive innovation." Proactive innovation shows that innovation comes from the condition of business and develops from the ability or schedule of the organization. It doesn't materialize from competitive pressure. Further, reactive innovation means that innovation begins from competition. Businesses encounter the pressure of the environment or competitors and feel forced to innovate (Su-Chao Chang, Chwan-Yi Chiang, Chen-Ying Chu, Yaw-Bin Wang, 2006).

We have studied the human capital management and its importance in innovativeness of firms. In this section, we discuss how to enhance innovativeness by (including) implementing particular HCM practices, in other words, the Competence Management and Knowledge Management could be this particular practices. The HCM with its particular practices (CM+KM) could direct researchers or Centers to the innovativeness. In our study we focus on CM and KM as fundamental practices of HCM (Fig. 4).

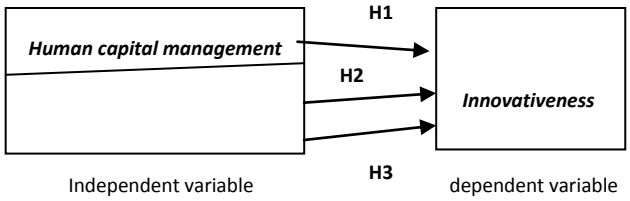
In our case, Centers will search for an effectiveness way to apply the HCM with its particular practices in order to develop valuable and unique knowledge that favors innovation. Thus, we propose the following hypothesis:

H_1: Human Capital Management HCM has a positive effect on Innovativeness of research Center.

H_2: Competencies Management CM has a positive effect on Innovativeness of research Center.

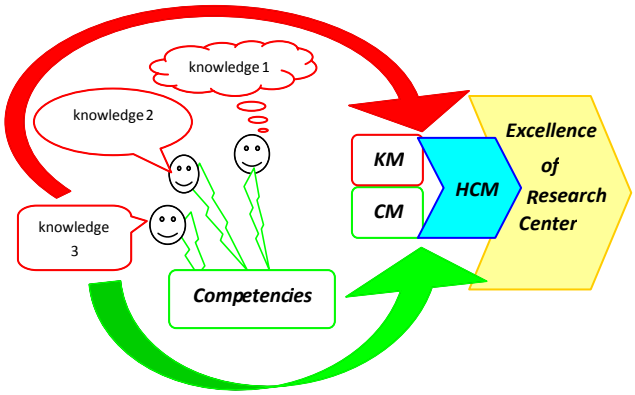
H_3: Knowledge Management KM has a positive effect on Innovativeness of research Center.

Fig .3:
the research model



Source: *proposed by the Author based on Literature review*

Fig . 4:
HCM & Excellence of Research Center: Approach CM & KM



Source: *proposed by the Author*

2.5. Methods

2.5.1. 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 (Tab. 1). 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, (**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, HCM and innovation.

This study adopted five-point Likert scale. Based on the literature, thirty-seven-items questionnaires were developed for HCM and innovativeness divided three parts as follows: 19 for CM (Q1-Q19), 10 for KM (Q20-Q29) and 7 for innovativeness (Q30-Q37).

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 2013.

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.

Tab . 1:
The scientific research centers in Algeria

N	Initials	Number of permanent researchers	Denomination
01	CDER	234	Center for Renewable Energy Development (Algiers)
02	CERIST	63	Research Center for Scientific and Technical Information (Algiers)
03	CDTA	250	Center for Development of Advanced Technologies (Alger)
04	CSC	74	Center for Scientific Research and Technology in Welding and Control (Algiers)
05	CRAPC	61	Center for Scientific and Technical Research in Physical Analysis - Chemical (Algiers)
06	CRSTDLA	29	Center for Scientific and Technical Research on the Development of Arabic Language (Algiers)
07	CREAD	52	Center for Research in Applied Economics Development (Algiers)
08	CRASC	55	Center for Research in Social and Cultural Anthropology (Oran)
09	CRSTRA	60	Center for Scientific and Technical Research in the Dry Areas (Biskra)
10	CRBt	46	Center for Research in Biotechnology (Constantine)
Total		**924**	

Source: *Data established based on the web site http://www.mesrs.dz and research centers (statistics 2013).*

2.5.2. Data analysis:

2.5.2.1. The personal characteristics of researchers of Centers:

The personal characteristics of researchers according to: Gender, age, diploma, grade, experience, and income in addition to past interviews allow us to draw the following conclusions:

- Women (45.3%) and men (54.7%) are represented in a balanced way in the centers.
- The majority of the population is young researchers (78.9%). 76.4% had a post-graduate degree (Magister) and 19.3% hold a PhD, Engineers represent 4.3%.
- More than 75.8% 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), 54% 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.

2.5.2.2. Validity and Reliability test

To verify the validity and reliability of each construct, purification processes including validity and reliability analysis are conducted in this study. Through reliability test, this study found their Cronbach's α was more than 0.65, which means that these questionnaires have enough reliability. 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 (Pedro Soto-Acosta, A.L.Merono-Cerdan, 2008). The results of the validity indicate that each variable had been significant loading (the most significant loadings ranged from 0.635 to 0.830 on their path loadings at the level of 0.01.

2.5.2.3. Normality analysis

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. Following to the recommendation of many researchers that the skewness and kurtosis indices should be not exceed an absolute value of 1 and 3 (M.S.Awwad, J.A.Agti, 2011). Respectively, data in this study is regarded as normal.

2.5.2.4. Test the convergence of views of respondents (Mean)

According to the Mean of the most of variables is located between 2.841 & 2.994, which mean that the researcher's answers are located in the third box on the Likert scale.

This leads to the conclusion that there is an average level of HCM in research Centers and an average level of innovativeness, except the KM is located in the fourth box on the Likert scale, which mean that there is a good level of KM in research centers.

2.5.2.5. Relationships among HCM, CM, KM and Innovativeness of research center:

According to the simple regression analysis Person we found that:

- Human capital management is positively related with the innovativeness of the Center (70%).
- Competencies management is positively related with the innovativeness of the Center (64%).
- Knowledge management is positively related with the innovativeness of the Center (83%).

According to the multiple regression analysis:

- Human Capital Management HCM has a positive effect on Innovativeness of Center. This hypothesis is verified at (*R2*= 0,486, β=0,697 & t=8,650).
- Knowledge management KM has a positive effect on Innovativeness of Center. This hypothesis is verified at (R2=0,688, β=0,830 & t=8,405).
- Competence Management CM has a positive effect on Innovativeness of Center. This hypothesis is verified at (R2=0,404, β=0,635 & t=7,315).

Therefore, it is clear that relationships do exist between HCM, CM, KM and innovativeness of research center. This finding provides sufficient support of H1, H2, H3. Human capital management is important in enhancing innovativeness of the Research Center. More specifically, human capital management depends on its competencies management and knowledge management.

2.6. The contribution of HCM to research Centers innovativeness:

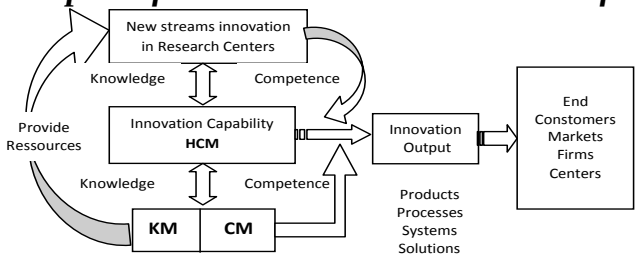
The final stage of our investigation seeks to learn whether those Research Centers with the appropriate HCM obtain not only innovations but also a higher performance (excellence).

According to the literature, innovation is one of the main sources of excellence. If Research Centers develop innovation 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, and 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 (Fig. 5).

Fig. 5:

The impact of HCM on the Innovativeness of Research Center: Approach CM & KM



Source: *proposed by the Author based on Benn Lawson & Danny Samson, 2001.*

2.7. Conclusion and future research:

Today, innovation depends on intangible assets especially human capital. Moreover, human capital management 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 (Fida Afiouni, 2009). HCM is important in enhancing innovativeness of the Research Centers. More specifically, human capital management depends on its competencies management and knowledge management which have also an important effect on innovation.

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 Research Centers develop innovation 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, they will adapted to the needs and 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.

2.8. References:

(1) Afiouni Fida, (2009). "Human Capital Management, What does it Really Mean?" *Proceedings of the European Conference on Intellectual Capital, in Holland University of Applied Sciences, Haarlem, The Netherlands, 28-29 April.*

(2) Barney. J, (1991). Firm Resources and sustained competitive advantage. *Journal of Management, Vol. 17, No. 1, pp 99-120.*

(3) Baron Angela and Armstrong Michael, (2007). *"Human capital management".* Publisher: Kogan Page Ltd, London, GBR, p 21.

(4) Bontis Nick and Fitz-enz Jac, (2002). 'Intellectual capital ROI: a causal map of human capital antecedents and consequents'. *Journal of Intellectual Capital, Vol. 3 No. 3, pp 223-247.*

(5) Bontis. N, (1999). 'Managing organizational knowledge by diagnosing intellectual capital: framing and advancing the state of the field', *International Journal of Technology Management, Vol. 18, No. 5–8, pp.433–62.*

(6) Cabello-Medina Carmen, Lopez-Cabrales Alvaro and Valle-Cabrera Ramon (2011), Leveraging the innovative performance of human capital through HRM and social capital in Spanish firms, *The International Journal of Human Resource Management, Vol. 22, No. 4.*

(7) Chatzkel. J.L, (2004). 'Human capital: the rules of engagement are changing', *Lifelong learning in Europe, Vol. 9, No. 3, pp.139–145.*

(8) Choudhury Jyotirmayee and Mishra B. B, (2010). "Theoretical and Empirical Investigation of Impact of Developmental HR Configuration on Human Capital Management". *International Business Research, Vol. 3, No. 4. October, pp.181–186.*

(9) Davenport, T. H., Prusak, L., & Wilson, H. J. (2003). Who´s bringing you hot ideas and are you responding? *Harvard Business School Press, Vol. 81, No. 2, pp 58-64.*

(10) Edmonson, A. (1999), Psychological safety and learning behaviour in work teams. *Administrative Science Quarterly, Vol. 44, No. 2, pp 350-383.*

(11) Edvinsson, L., & Malone, M. S, (1997). *El Capital Intellectual: Cómo Identificar y calcular el valor de los recursos intangibles de su empresa*: Gestión 2000.

(12) Edvinsson, L., Sullivan, P., (1996). Developing intellectual capital at Skandia. *Long Range Planning Vol. 30, No. 3, 366-373.*

(13) Fawzy Soliman (2011), could one transformational leader convert the organization from knowledge based into learning organization, then into innovation?, *journal of modern accounting and auditing, Vol.7, No.12, Decembre.*

(14) Finn. R, (2003). 'Human-capital management (HCM): a three-letter acronym too far for HR or the way to get the people agenda on to that of the board?' *Human Resource Management International Digest, Vol. 11, No. 5, pp.2–4.*

(15) Hannula Mika, Kukko Marianne, Okkonen Jussi, and Yliniemi Terhi, (2003). "Competence and knowledge management practices in the finnish large-scale enterprises". *frontiers of e-business research, pp 463-473.*

(16) Harman Christopher, (2007). "Managing Human Resources in the Knowledge Economy". *7th Global Forum on Reinventing Government Building Trust in Government, Vienna-Austria, 26 –29 June, pp 01-08.*

(17) Helena Santos-Rodrigues, Pedro Figueroa Dorrego, Carlos Fernandez Jardon (2010), The Influence Of Human Capital On The Innovativeness Of Firms, *International Business & Economics Research Journal, September 2010, Volume 9, Number 9.*

(18) Huber, G. P. (1991). Organizational Learning: the Contributing Processes and the Literature. *Organization Science, Vol. 2, No. 1, pp. 88 - 115.*

(19) I.A.D.E.-C.I.C. (2003). *Modelo Intellectus: medición y gestión del capital intelectual* (Documentos Intelectos). Madrid.

(20) Kaplan, R. S., & Norton, D. (1999). *Cuadro de Mando Integral (The Balanced Scorecard)*. España: Gestión 2000.

(21) Kearns, P. (2005, *Human Capital Management*, Reed Business Information, Sutton, Surrey.

(22) Lawson Benn, Samson Danny (2001). Developing innovation capability in organizations : A dynamic capabilities approach, International journal of management, Vol 05, n° 03, Imperial college press, Australia.

(23) Lopes Ilídio, do Rosário Martins Maria, and Nunes Miguel, (2005). "Towards the Knowledge Economy: the Technological Innovation and Education Impact on the Value Creation Process". *Electronic Journal of Knowledge Management, Vol. 3 Issue 2, pp 129-138, available online at www.ejkm.com*

(24) Lucia, A., & Lepsinger, R. (1999). *The art and science of competency models: Pinpointing critical success factors in organizations*. San Francisco: Jossey-Bass/Pfeiffer.

(25) Mahoney Josepht and Pandian J. Rajendran, (1992). "The resource-based view within the conversation of strategic management". *Strategic Management Journal, Vol. 13, No.5, June, pp 363-380.*

(26) Marrelli Anne F, Tondora Janis, and Hoge Michael.A, (2005). "strategies for developing competency models". *Administration and Policy in Mental Health, Vol. 32, No. 5/6, May/July, pp 533-561.*

(27) Marrelli, A.F. (1998). An introduction to competency analysis and modeling. *Performance Improvement, Vol. 37, No. 5, pp 8–17.*

(28) Marrelli, A.F. (2001). *Introduction to competency modeling*. New York: American Express.

(29) Mat Isa Rosmah, Liza Abdullah Nor, Noradiva Hamzah, and Ashad Rasidah, (2008), "The typology of intellectual capital and knowledge management in Malaysian hotel industry". *The journal of human resources and adult learning, Vol.4, No.2, December, pp 103-114.*

(30) Medard Nana Djomo Jules and Sikod Fondo, (2012). "The Effects of Human Capital on Agricultural Productivity and Farmer's Income in Cameroon". *International Business Research, Vol. 5, No.4. April, pp 149-159.*

(31) Mirabile, R. (1997), "*everything you wanted to know about competency modeling*", Training and Development, pp 73–78.

(32) Mohd.Yusoff Yusliza, Shah Abdullah Hazman, (2008). "Managing Human Capital in a Knowledge Based Economy: The Role of the HR Function". *Proceedings of the Knowledge Management International Conference, Transferring, Managing and Maintaining Knowledge for Nation Capacity Development, Langkawi, Malaysia, 10-12 June, pp 178-183.*

(33) Pfeffer,J, (1994), "*Competitive advantage through people: unleashing the power of the workforce"* (Boston, MA: Harvard Business School Press).

(34) Roos, R., Roos, J., (1997, "Measuring your company's intellectual capital performance", *Long Range Planning Vol. 30, No. 30, pp 413-426.*

(35) Santos-Rodrigues Helena, Figueroa Dorrego Pedro, and Fernandez Jardon Carlos, (2010). "The Influence of human capital on the innovativeness of firms". *International Business & Economics Research Journal, Vol. 9, No. 9, September, pp 53-64.*

(36) Sarrocco Claudia, "intellectual capital in the information society", *pp 01-43, available at: http://www.itu.int/visions. [Accessed 16th September 2012]*.

(37) Soto-Acosta Pedro and Merono-Cerdan Angel Luis, (2008). "Analyzing e-business value creation from a resource-based perspective". *International Journal of Information Management 28, pp 49-60, www.elsevier.com/locate/ijinfomgt. [Accessed 12th October 2012]*.

(38) Stam Erik and Garnsey Elizabeth, "Entrepreneurship in the Knowledge Economy", *pp 01-24, available at: http://www.dur.ac.uk/resources/dbs//faculty/centre_entrepreneurship/publications/ResearchPaper018.pdf [Accessed 16th September 2012]*.

(39) Su-Chao Chang, Chwan-Yi Chiang , Chen-Ying Chu, Yaw-Bin Wang (2006), The Study of Social Capital, Organizational Learning, Innovativeness, *Intellectual Capital, and Performance, The Journal of Human Resource and Adult Learning.*

(40) Sucio Marta-Christina, (2000). "Intangible assets and intellectual capital as key factors of romania's convergence", *pp 01-43, Available at www.moyak.com/.../knowledge-based-economy- April 2012. [Accessed 26th July 2012]*.

(41) Suleiman Awwad Mohammad, Agti Jouhra Ali, (2011). "The effect of organizational commitment on Jordanian commercial banks market orientation". *Abhath Al-Yarmouk- humanities and social sciences series, Yarmouk university publication-Jordon, Vol.27, No.(2-C), 08th May, pp 1920-1930.*

(42) Suresh B.K, Paramashivaiah .P, and Bansode Vikas, "Knowledge Management, Strategy and Competitiveness An opportunity and Challenge for Organizational Excellence in the Globalized era*", pp 1-10. available at: www.wbiconpro.com/409-Suresh.pdf.* [Accessed 25th October 2012].

(43) Sveiby, K.E., (1997). "The intangible asset monitor". *Journal of Human resource Costing and Accounting, Vol. 2, No. 1, pp 73-97.*

(44) Sydänmaanlakka, P. (2000). "*Älykäs organisaatio. Tiedon, osaamisen ja suorituksen johtaminen*". Helsinki, Kauppakaari Oyj. p 283.

(45) T.T. Selvarajan, Nagarajan Ramamoorthy, Patrick C. Flood, James P. Guthrie, Sarah MacCurtain and Wenchuan Liu (2007), the role of human capital philosophy in promoting firm innovativeness and performance: test of a causal model, *Int. J. of Human Resource Management 18:8.*

(46) Whicker, L.M and Andrews, K. M, (2004). "HRM in the Knowledge Economy: Realising the Potential". *Asia Pacific Journal of Human Resources, Vol.42, No 2, pp 156-165.*

(47) Wickes Martin, Leslie Annette, Lettice Fiona, a perspective of NONAKA'S SECI MODEL from programme management: combining management information, performance measurement and information design, available at:

(48)
http://www2.warwick.ac.uk/fac/soc/wbs/conf/olkc/archive/oklc4/papers/oklc2003_wickes.pdf.

(49) Wright, P.M, McMahan, G.C, and Mac Williams. A, (1994), "human resources and sustained competitive advantage: a resource-based perspective", *International Journal of Human Resource Management, Vol. 5, No. 2, pp 301-326.*

(50) http://www.clemson.edu/Centersinstitutes/tourism/documents/sample-scales.pdf. [Accessed 16th September 2012].

(51) http://www.mesrs.dz. [Accessed 12th December 2011].
http://rahulgunti.blogspot.com/2009/02/nonakas-seci-model.html [Accessed 16th September 2012].