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Original Research

Investigating the Long-run Influences of Human Capital on Innovation and Economic Growth in MENA Countries

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Abstract

Human capital is supposed to be an important factor in innovation and economic development. However, the long-run influence of human capital on current innovation and economic development is still unclear, in particular in the MENA region. Therefore, the present study is to investigate the long-run influence of human capital on innovation and economic growth in MENA countries for the years 2010-2012. The data were collected using the library method from the World Bank database and were analyzed using statistical and econometric methods for panel data. The results obtained from this study showed that human capital had a positive, significant influence on innovation and economic growth in MENA countries. The same influence was observed for the population density in some age groups (more educated people) on the patents in MENA countries.

Keywords: Human capital, Innovation, Economic growth, MENA region.

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Introduction

Innovation as one of the key drivers of economic growth is needed by any society to achieve its goals related to the knowledge-based economy in moving towards sustainable economic growth and development. In developed countries, innovation plays a bold role in the infrastructural changes in economic growth. In the present era, known as the age of knowledge and information, human power can be considered an economic privilege when it is of high knowledge and intellectual ability. Because the economists, it is one of the factors that can make difference in the economic growth of developed and developing countries (Kazeroni et al., 2014). Human capital is a complement of physical capital in this way that the first can lead to better use of the later. The experiences of the developed countries and various studies on the economic growth of the countries over time or among the countries have demonstrated that the rate of economic growth is not explainable only by conventional factors such as capital and workforce. Human capital, as a main variable, should be included in the growth models. The studies investigating the effective factors on economic growth have attributed less than half of the percentage of growth to the main factors of production (labor, capital, and land) and the rest to the unknown factors like technology, increase in productivity, etc. Human capital is an effective qualitative factor in the production process, which is not explainable by labor. It appears that it has only one source: education (Emadzadeh et al, 2008).

Although many thinkers believe that human capital has a considerable role in innovation and economic growth, the way human capital influences innovation and economic growth, its influence mechanisms, and the short-run and long-run influences brought about by it has not completely been known. Thus, such factors are necessary to investigate to unveil how and how much human capital influences innovation and economic growth. In many countries, realizing sustainable development goals has strongly to do with economic and financial sector development and innovation and many thinkers believe that human capital has a bold role in innovation and economic growth and development of different societies (Niknami et al., 2014). Nevertheless, the way human capital influences innovation and economic growth, its influence mechanisms, and its short-run and long-run effects on economic growth and development are not completely known. Thus, it is necessary to investigate this variable (human capital) and its effects in various societies including MENA countries, regarding their economic characteristics.

MNEA refers to a group of countries situated in and around the Middle East and North Africa, which are the main producers of oil. The economy of these countries has a close relationship with the global oil price changes. This region is one of the oldest oil fields and for this reason, the oil reserves of the countries of this region have experienced more decrease compared to the other regions and the wear and tear of oil drilling and extraction tools are more evident. During the past few decades, many of these countries have turned to physical and human investments in various sectors to reduce dependence on the oil industry, one of which is human capital. However, the unemployment rate is high in these countries despite abundant oil and physical resources. Thus, the present study investigates the role of human capital in innovation and economic growth to show how these capabilities (oil and physical resources) can be used properly for regulating the economic

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relations among MENA countries and increasing innovation and economic growth. In this respect, the question is what are the long-run influences of human capital on innovation and economic growth in MENA countries?

Literature Review

The global market is always a challenging field for countries in the world. These countries are facing conditions like increasing complexity and change, globalization, customer needs, and intense competition. Therefore, product development and innovation are vital to survive. Countries are always seeking ways to avoid uncertainty and to find conditions to give them the ability to predict the future and make the necessary arrangements for it. We call a country successful if it moves toward innovation and creativity (Delmas and Pekovic, 2013). Innovation as one of the key drivers of economic growth is needed by any society to achieve its goals related to the knowledge-based economy in moving towards sustainable economic growth and development. In developed countries, innovation plays a bold role in the infrastructural changes in economic growth. In the present era, known as the age of knowledge and information, human power can be considered an economic privilege when it is of high knowledge and intellectual ability. Because the economists, it is one of the factors that can make difference in the economic growth of developed and developing countries (Kazeroni et al., 2014).

Innovation means a meaningful change for improving the services and the routine processes and for creating new values for the beneficiaries and it focuses on the leadership to achieve new dimensions (Vahnani, 2015). Innovation is formed in a social, political, and institutional context strongly tied to the economic features of each region (Deloreux and Parto, 2005). Interactions among different sectors of the region, including technical, commercial, legal, social, and financial ones, can contribute to the development, protection, funding, and legislation of innovation and technology. Innovation is a process dependent on geography and region where local capabilities like resources, institutions, and public and cultural values are the key drivers. Generally, various regions and countries can ensure a mid-run and long-run development by making changes in the type of innovation management (Ferrara et al., 2012).

In this respect, by time, experience, goal, and capabilities, human capital can play a bold role in the performance of innovation. Innovation by human capital, as mainstream in the economic literature, came into being in the early 1960s, when economists attempted to provide a convincing explanation for a significant unexplained portion of economic growth (Sultani Firouz & Isapour, 2012). However, in the late 1980s, human capital was included in economic growth patterns as a factor of production. The lack of innovation is one of the main reasons for the low economic growth rate in developing countries. This and the efficiency and proficiency of the workforce and capital do not increase until these countries promote the innovation and necessary training on how to use science and knowledge and increase the level of professional skills(Shahabadi et al., 2014). Therefore, human power, or in other words, human capital is considered the most important factor in gaining competitive privilege among countries and is the main intangible asset. It also can be considered as a basis for improving the quality and productivity of all economic processes (Alexandru & Hudson, 2005).

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On the other hand, economic growth is a common goal of every economy. The reason is achieving many privileges and interests, which can be realized through economic growth. Economic growth means a steady increase in GDP. In this regard, training is the main axis for economic growth. The experiences of the developed countries show that physical capital and working population are not enough for explaining the economic growth rate. Some other factors can be mentioned. Such factors, called residual factors, are the main reasons for increasing the productivity of capital and human power (Emadzadeh et al, 2011). Until now, capital has been the first concept and effective factor in economic growth in growth patterns. Changes in production or economic growth were explained by changes in the physical capital accumulation in this way that it was expected that higher physical capital accumulation in a country would lead to more increase in its economic growth. However, the experiences of the developed countries in the economic growth during the time or among countries indicated that the economic growth rate, which is only explainable by conventional factors such as capital and labor, would not be fruitful and the human capital, as a main variable, should be included in the growth models. Thus, the fact is that not all economic changes can be explained by physical capital accumulation (Paseban, 2013). Therefore, it is very important to pay attention to all capital, especially human capital. In fact, from an economic theories perspective, the role of human capital in the process of economic growth has undertaken remarkable changes. These changes have a diverse range where a concept called workforce or labor on one end and it is only evaluated through physical capabilities and human capital is on the other end which is the result of the accumulation of knowledge, skills as well as experience(Mahdavi & Barkhordari, 2013). Thus, to achieve the main goals of this research, the following hypotheses were addressed and tested:

H_1: Human capital has a significant effect on the number of patents in MENA countries

H_2: Population density in some age groups has a significant effect on the number of patents in MENA countries

H_3: Human capital has a significant effect on GNP in MENA countries

In today's economy, knowledge and expertise is the basis of wealth creation. Using elements of innovation (knowledge and information), the countries can create wealth. Thus, economic experts have directed their attention toward innovation as a necessary component to improve the life level and well-being of people and societies. In general, Innovation means changing an idea to a product or a new service to achieve economic privilege. Human capital is one of the variables, which is highly effective in innovation in a region. This paper is to investigate the long-run influences of human capital on innovation and economic growth in MENA countries. In the rest of the paper, some studies in this field have been noticed. Paseban (2013) investigated the effect of human capital on the economic growth of MENA countries. The results showed that there was a positive, significant relationship between the human capital index and the economic growth of MENA countries. Shahabadi and colleagues (2013) investigated the determinants of innovation, emphasizing the human capital in the countries of the Organization of Islamic Cooperation. Their results showed that human capital, as a

variable did not influence innovation whether in general to in particular (basic education, university education, and research and development sector) manner.

Vahnani (2015) researched the effect of human capital on the performance of innovation, considering the mediating role of dynamic capabilities. Their findings showed that human capital and dynamic capabilities had a positive, significant influence on the performance of innovation and human capital had the same influence on dynamic capabilities. However, in external variable indicators, the effect of quantity, appropriateness, and complementarity on the ability to use opportunities was not significant. In their study, Besharati Kalaye et al. (2017) focused on the effect of human capital on innovation in developing and developed countries. They analyzed 113 countries in four income categories using data from the World Bank and the Global Innovation Index. The results obtained from each category showed that in (down top) moving towards development, attention should be paid to the skills and training of human resources according to the situations in each country. Kazerooni and others (2014) studied the influence of intellectual property rights and human capital on innovation in MENA countries. The results obtained from the estimation of the model indicated that human capital accumulation has a significant, positive influence on innovation, that is, the higher the level of an individual's education, the more innovation. Van Uden and colleagues (2014) investigated the relationship between human capital and innovation. They collected the data related to the selected countries (Kenya, Tanzania, and Uganda) obtained from a survey from the World Bank and concluded that there was a positive relationship between human capital and innovation.

McGuirk and others (2015) measured a concept called "innovative human capital" and its impact on small firms' propensity to innovate. There was evidence from the results that Innovative Human Capital may be more valuable to small firms (i.e. less than 50 employees) than larger-sized firms (i.e. more than 50 employees). The research expands innovation theory to include the concept of Innovative Human Capital as a competitive advantage and determinant of small firm innovation. Plinoskova (2015) analyzed the impact of human capital on the economic growth of EU countries. In that paper, the importance of human capital in ensuring (gross) economic growth was highlighted. The results showed there was a positive relationship between GDP per capita, the innovative capacity of human capital (confirmed by the number of patents), and employee conditions (secondary education). Chindo et al. (2015) conducted a research entitled "Human Capital, Technology, and Economic Growth: Evidence from Nigeria". The cointegration result revealed that all the variables in the two separate models were cointegrated. Furthermore, the results of the two estimated models showed that human capital had a significant positive impact on economic growth. Diebolt and Hippe (2019) investigated the long-run impact of human capital on innovation and economic development in the regions of Europe. This article made a connection between the past and the present. Using a large new dataset on regional human capital and other factors in the 19th and 20th centuries, they found that past regional human capital was the main factor, which explained present regional differences in innovation and economic development.

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Methodology

By goal, this research is applied and by method, it is descriptive-analytical. The period is 2010-2012 and the geographical area is the countries of the MENA region. Therefore, the present study is to investigate the long-run influence of human capital on innovation and economic growth in MENA countries for the years 2010-2012. The data were collected using the library method from the World Bank database. The data were analyzed using statistical and econometric methods for panel data. The results obtained from this study showed that human capital had a positive, significant influence on innovation and economic growth in MENA countries. The same influence was observed for the population density in some age groups (more educated people) on the patents in MENA countries. For the contents related to the subject, the library method was used. For this purpose, books, magazines, articles, theses, etc. were referred to. The statistical data were analyzed using the panel data econometric method. Required statistics and information were extracted from the database of the World Bank website. In Table 1, the variables used in the models, their abbreviations, and the sources of the collection have been presented.

Table 1. Variables investigated in the research

Variable	Abbreviation	Source of data collection
Human capital	ABBC	World Bank website
population density	Population density	World Bank website
Number of patents	Patents/c	World Bank website
National production per capita	GDP/c	World Bank website
Literacy	Literacy	World Bank website
Death rate	Mortality	World Bank website
Birth rate	Fertility	World Bank website

In this study, the following model was used to investigate the long-run influence of human capital on innovation and economic growth (Diebolt and Hippe, 2019):

$$\text{In}(\text{Patents}/C_j) = \beta_0 + \beta_1 H_j + X_j + \varepsilon_j$$
$$\text{In}(\text{GDP}/C_j) = \beta_0 + \beta_1 H_j + X_j + \varepsilon_j \quad (1)$$

Where,

(Patents/c): number of patents per million

(GDP/c): GDP per capita

H: human capital index

X: control variables

Given the characteristics of the data including time series information and cross-sectional data, the panel data was used. Panel data analysis is very similar to variance analysis, which is mixed with a time series analysis as a multivariate, and then the effect of random or fixed factors in the model is examined. At times, the data we are dealing

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with are both time series and cross-sectional. Both modes are identified using the F-Limer test. Thus, this test can be applied for selecting between pooled data regression methods (combined) and regression with fixed effects. Hausman test was also used to show the compatibility of a model with data, especially in econometrics. This test is based on the existence or non-existence of a relationship between the estimated regression error and the independent variables of the model.

Findings

First, the stationarity of the variables in the models was examined using Levin- The lin-Chu test. It is designed to test the null hypothesis of a common unit root in the panel versus the alternative of stationarity. It was performed for all the variables in the model and the results have been presented in Table 2, briefly. As the results show, the variables are static at the data level and their stationarity has no problem.

Table 2. Levin- Lin-Chu test to estimate the stationarity of the time series data

Series	Levin statistic	The level of significance	Obs
Human capital	-2.33	0.0097	170
population density	-2.06	0.0192	7
Number of patents	-6.20	0.0000	153
National production per capita	-3.03	-0.0088	170
Literacy	-4.06	0.0046	59
Death rate	-3.47	-0.0113	127
Birth rate			

The first model of the research examines the influence of human capital on innovation. It is at below:

$$\mathrm{In}(\mathrm{Patents}/\,C_j) = \beta_0 + \beta_1 H_j + X_j + \varepsilon_j \qquad (2)$$

In this section, the tests needed for estimating the model and the results are presented. The method of data estimation should be determined to use the proper research model for MENA countries. First, the F-Limer test is used to determine the existence or non-existence of the y-intercept for each country. As Table 3 shows, the F-Limer test with 5 and 24 degrees of freedom is statistically significant at the 95% confidence level, thus the group effects are accepted and various y-intercepts should be included in the estimation. Once it is confirmed that the y-intercept is different for each country, this hypothesis should be tested whether the fixed effects method or the random effects method can be used for determining the model. For this purpose, the Hausman test is used.

Table 3. The results of the F-Limer test to identify the pattern

F statistic	Degree of freedom	Probability
9.452	5, 24	0.0056

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To test the possibility of determining the model using fixed effects or random effects, the Hausman test was used as follows. The results in Table 4 show that the 2-tailed test statistic is statistically significant at 95%. Thus, the null hypothesis is rejected. As a result, the random effects method is not appropriate and we should use the fixed effects method.

Table 4. the results of the Hausman test for selecting fixed effects or random effects

Chi-squared statistic	Degree of freedom	Probability
23.651019	3	0.0000

The first model of the research designed for estimating the influence of human capital on innovation is as follows:

$$\text{In}(\text{Patents}/\, C_j) = \beta_0 + \beta_1 H_j + X_j + \varepsilon_j \qquad (3)$$

In this model, the control variables are population density, death rate, and birth rate. In Table 5, the results of the model have been presented. As the results show, the coefficient of human capital is statistically at the significance level of 95%. It indicates that human capital in MENA countries contributes to the increase in the number of patents during the period of study. Moreover, in the case of the effect of the population density in age groups on the number of patents, it was highlighted that the results are statistically significant at the 95% confidence level. It indicated that human capital in MENA countries contributes to the increase in the number of patents during the period of study.

Table 5. the results of estimating the influence of human capital on the number of patents in MENA countries

	The estimation of the model using the fixed effect method		
	Coefficients	t statistic	Probability
Fixed Coefficient	0.331452	5.36524	0.0120
Human capital	0.023654	8.5201	0.008
Population density	0.23410	4.2354	0.007
Death rate	0.08941	2.3827	0.026
birth rate	0.017029	2.4849	0.021
Degree of freedom	1.4120	4.3301	0.000
R^2	0.602144		
Adjusted R^2	0.601362		
F statistic	7.62415		0.000321

The results reported for the death rate and birth rate are not statistically significant at the 95% significance level. It shows that these two variables in MENA countries have not led to an increase in the number of patents in these countries. The second model investigates the influence of human capital on economic growth. It is written as follows:

$$\text{In}(\text{GDP}/\, C_j) = \beta_0 + \beta_1 H_j + X_j + \varepsilon_j \qquad (4)$$

In this section, the tests needed for the estimation of the model and the results are presented. The existence or non-existence of the y-intercept was determined using the F-

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Limer test. The results of the second model can be seen in Table 6. As the Table shows, because the F-Limer test with 5 and 24 DF is statistically significant at the 95% confidence level, group effects are accepted and the different y-intercepts are considered. Then, this hypothesis is tested that whether fixed effects or random effects should be used to estimate the model. For this purpose, the Hausman test is used.

Table 6. The results of the F-Limer test in the second model

F statistic	DF	Probability
6.406	5, 24	0.0037

To test whether fixed effects or random effects can be used to estimate the model, the Hausman test can be used as follows. As the results in Table 7 show, the chi-square test statistic is statistically significant at the 95% confidence level. Thus, the null hypothesis is rejected and the fixed effect method is better to use.

Table 7. The results of the Hausman test to select the fixed effect or random effects

$\chi 2$ statistic	DF	Probability
21.3245	3	0.0142

The second model for investigating the influence of human capital on economic growth is written below:

$$\text{In}(\text{GDP}/C_j) = \beta_0 + \beta_1 H_j + X_j + \varepsilon_j \qquad (5)$$

The results of estimating the model are presented in Table 8. As the Table shows, the variable coefficient of human capital is statistically significant at the 95% confidence level. This indicates that human capital in MENA countries has led to an increase in GNP in these countries during the studied period. In the cases of population density and birth rate, the results are statistically significant at the 95% confidence level, which shows these two variables in the region have led to the increase of GNP in the countries during the studied period. However, in the case of the death rate, the results are insignificant and this variable has been shown to not affect GNP.

Table 8: The results of the influence of human capital on GNP in MENA countries

The estimation of the model using the fixed effect method			
Explanatory variables	Coefficients t statistic	t statistic	Probability
Fixed Coefficient	0.062513	4.32014	0.000
Human capital	0.033145	5.66321	0.00236
Population density	0.18742	0.22145	0.002
Death rate	-0.02791	-0.21590	0.8293
birth rate	0.15304	6.16847	0.000
Degree of freedom	3.6254	4.2301	0.00142
R^2	0.640031		
Adjusted R^2	0.631523		
F statistic	9.6852		0.0000237

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Discussion and Conclusion

As it was shown in the findings section, three main hypotheses are confirmed. It means human capital has a positive, significant influence on the number of patents and the amount of GNP. In addition, the population density in some age groups has the same influence on the number of patents in MENA countries. Patents are often the output of R&D and the most important performance indicators of science and technology, which can indicate the effectiveness of R&D costs. Therefore, it can be considered as a main complement for other information sources to measure scientific and technological information of the countries. Inventions in MENA countries are of more importance because of the dependency of these countries on the source of oil income and it can help them exit from a one-product economy and improve growth and development. To achieve this aim, they need skillful and trained human resources. In today's competitive world, human capital has changed into a fundamental concept for companies and organizations and has strongly impacted their survival. Human capital is the most effective factor in organizational growth and survival. All organizations want to attract and, even more importantly, retain and develop the most competent individuals to do their current and future activities so that they can realize their predetermined goals and strategies. GNP is the most important variable used in the analysis and evaluation of the macroeconomy. It is a flow variable, which is defined as the annual Iranian Rial value of all final goods and services produced at current (market) prices in the national economy. In this respect, a country with efficient human capital can supply the final goods and services with the highest quality in the market and lead to an increase in GNP.

Education builds human capital, which includes the skills needed for the traditional and modern sectors of the economy. It also boosts the productive power of individuals. It increases financial income by creating the ability of productive power, particularly, in the labor force. The thesis of human capital theory is that education renders people more productive, which, in turn, increases economic growth. It has been confirmed in most domestic and foreign studies that human capital is the main dimension and capacity of economic growth and development. The difference in the growth rate among countries and its stability or instability is a phenomenon explained in various ways by growth theories. These theories attribute this difference to several factors. Most economists agree on this point that human capital is what ultimately determines the process of economic and social development of a country and the role and importance of human capital, in this case, is as much as physical capital. Such a role can be more understood if the prominent records of countries such as Japan, Taiwan, Hong Kong, South Korea, and other rapidly growing economies in Southeast Asia are considered. These countries most of which have fewer natural resources have been successful to experience rapid growth because of having experienced, skillful, trained, and hard-working workforce. Increasing and improving the indices related to human capital like level of literacy, the skills of employees, health and life expectancy, per capita income, and other ones in a country can both contribute to gaining economic benefits such as increasing productivity and realizing the goals of economic development and increase in efficiency. Thus, all countries should give importance to human capital and attempt to improve the indices related to it.

According to the results, countries that invest more in human resources and the fact their workforce has a higher level of technical and educational knowledge can invent

more products and supply them to global markets. To put it differently, developing international trade can be achieved by training the human force, which plays a very bold role in improving the productivity of all production factors and achieving higher economic growth. In this regard, it is recommended that MENA countries pay heed to this matter and have short-run and long-run plans to improve it. It is also recommended that countries pay heed to individual structures since human capital influences the number of patents. Because individual structures can lead to creating new ideas and aligning thoughts with the culture, they should not be neglected. Finally, MENA courtiers should support, financially and non-financially, research on basic sciences and academic research, which has public benefits and less private return. In this way, the motivation of research and development in the country can pave the way for economic growth and development in the long -run. For this aim, MENA countries should provide attractive educational and financial opportunities for intelligent and elite people so that they can contribute to the improvement of research, production of science, and development of knowledge and use their skills to realize the potential abilities of their countries. Moreover, different production institutions should be encouraged to invest in research and the use of effective human power and open the doors towards creating new ideas and desirable technologies.

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