

Influences of Innovation on Employment in Romania, in the European Context

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Abstract

This paper aims to identify and analyze the effect of innovations on the employment in Romania. The type of innovation chosen is broadband and we study its impact on human resource in science and technology (HRST) in Romania, compared to the EU average. As representative indicators are taken into account the broadband penetration rate and the number of HRST, during 2007 – 2011. In the research we made the conceptual boundaries of the above mentioned indicators and through a quantitative analysis and a unifactorial econometric model we show the influence of broadband on HRST, in Romania.

Keywords: broadband, employment, HRST

Introduction

Today's society presents a change in the way of purchasing, processing, transforming and distributing knowledge and information and this was made possible by the convergence of three technological keys: information technology, telecommunications and production of multimedia content, which together form the Information and Communication Technology sector. Very high growth rates are recorded in advanced countries, far superior to traditional sectors.

The sector presents a particular cost structure, which involves the use of high initial fixed cost, irrecoverable and independent of the sales volume, when producing a good or service through the use of ICT.

For example, the design of telecommunication technologies incorporating optical fiber or a database: once created the infrastructure, transportation cost of the service is insignificant and constant, being independent of the number of network users, reason why there is no limits of production or sale.

Important is not the technology by itself, but its functioning which allows access to knowledge, information and communication – elements more and more important in economic and social life. It contributes ”to the improvement in productivity of the capital and work factors, which lead to a rise and diversification in production. Thus, they make up an important source for the creation of new products, services and jobs, first within their own sector, and then, through the expansion of production and exchanges, in other economic activities as well.” (Pitorac and Cismaş, 2012)

For these reasons, this research conducts an analysis of how broadband penetration rate affects economic life, particularly human resource in science and technology (HRST). In the first part of the paper are presented the indicators and the methodology, then a literature review in the field of innovation and broadband. Research continues with a quantitative analysis of the studied indicators: employment, the rate of HRST in total employment and broadband penetration rate in Romania in comparison with the European Union, in the period from 2007 to 2011.

Material and Methods

This paper analyses the recent Romanian economy from 2007 to 2011 in the European context with the help of the following analysis indicators: broadband penetration rate and the number of HRST. The data series used were taken from the European database, EUROSTAT.

Broadband penetration rate is expressed in percentage and it is calculated as number of fixed broadband subscription reported to the total population multiplied by 100. Population taken into account is the one registered at the 1st January of each year.

The indicator Human Resource in Science and Technology (HRST) includes, in a broad sense, everyone who has successfully completed post-secondary education (or is working in an associated S&T occupation) and in the narrow sense, it covers only those with at

least university-level qualifications in natural sciences or engineering (or working in an associated S&T occupation).¹

Broadband affects employment in three ways: "in the first place, network construction requires the creation of direct jobs (such as telecommunications technicians, construction workers and manufacturers of the required telecommunications equipment) to build the facility; in addition, the creation of direct jobs has an impact on indirect employment (such as upstream buying and selling between metal and electrical equipment manufacturing sectors). Finally, the household spending based on the income generated from the direct and indirect jobs creates induced employment."²

Working methodology consists of a quantitative analysis of the indicators, a study of their dynamics during 2007 – 2011 and a construction of an econometric model which show how broadband penetration rate affects Human Resource in Science and Technology, and therefore total employment.

Literature review

Innovation is an important factor of the economic growth, of increasing the living standards and of the new economy. History shows that: "economic growth is not a simple repetitive process of adding factories and workers similar to those already existing; rather it can be said that it is an endless stream of inventions and technical jumps which lead to a substantial improvement of production possibilities of nations" (Samuelson and Nordhaus, 2000).

The importance of innovation was first highlighted by Joseph Schumpeter (1939). It represents the result of new combinations of existing resources and can take the form of new products, new production methods, new ways of organizing production, etc. This activity of combining the resources gives content to the entrepreneurship function, so the entrepreneurs can positively influence the economic growth.

In developing countries, technological process is achieved not only through their own innovations. Helpman (1993) highlighted that the imitation of the technologies used and created in developed countries have also an impact on the economic growth. Acemoglu and

¹ http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/hrst_st_esms.htm

² http://www.itu.int/ITU-D/treg/broadband/BB_MDG_Romania_BBCOM.pdf

Ziliboti (2001) revealed the impact of complementarity between technological progress and labor skills on the long-run economic growth rate. Matsuyama (2001) in his study of economic fluctuations noticed that on the long run, the accumulation rate of production factors is equal to the rate of innovation, but the economy will alternate between periods of massive investment and periods of increased innovation rate.

Regarding developing countries, as is the case of Romania, the efficiency of international transfer of technology is constrained by: differences in productivity (Howitt, 2000), existing social infrastructure (Hall and Jones, 1999), various interest groups (Parente and Prescott, 1994), differences in skills and capabilities of workers (Acemoglu and Zilibotti, 2001) and insufficient own-funds to cover the cost incurred in transferring the technology (Aghion, Howitt and Mayer-Foulkes, 2005).

With a profound economic crisis in the background, actions must be taken to create a genuine single on-line market, based on broadband, for the benefits of the digital economy to be used to their full potential. Thus, the availability of high speed internet access to citizens and companies and increased use of broadband has been identified as a major objective of the European Union.

Broadband represents a set of technologies that allow rapid transmission of large amounts of data in order to ensure access to a range of digital services. A general definition of broadband is hindered by issues such as: the dynamism of technological innovation, the different level of development on various layers and the coverage level of network infrastructure.

The main advantage of broadband is that it enables the execution of activities in a new form. For example, working from home via electronic communication systems represents a solution to problems such as: unemployment, transport and environment. E-learning provides an alternative to traditional learning and makes the student independent of the time and space managed by specific institutions.

Among the benefits derived from broadband, are³: supporting lifelong learning by removing social and geographical barriers; simplifying the relationships between companies, government and other organizations; new employment opportunities; more effective

³ <http://www.mcsi.ro/Minister/Domenii-de-activitate-ale-MCSI/Comunicatii-electronice/Strategii/Strategie-broadband>.

management which leads to increased efficiency and develops competitiveness.

Results and Discussion

The studied period, 2007 – 2011, is one of economic crisis and the analysis of the indicators reflects this. Table nr.1 presents the total employment, human resource in science and technology, broadband penetration rate and the rate of HRST in total employment in Romania.

Table nr.1. Total employment, HRST and broadband penetration rate in Romania

Years	Total employment (Thousands)	HRST (Thousands)	Broadband penetration rate (%)	HRST in Total Employment (%)
2007	9.353,3	2.308	5,0	24,68%
2008	9.369,1	2.416	9,0	25,79%
2009	9.243,5	2.477	11,7	26,80%
2010	9.239,4	2.548	13,1	27,58%
2011	9.137,7	2.688	14,0	29,42%

Source: Eurostat

The chain based indexes were calculated in order to emphasize the change of the indicators compared to the previous year. In the Table nr.2 it can be noticed that: total employment in Romania increased slightly in 2008 compared cu 2007, by 0.12%, but from 2009 it decreases with 1.4%, in 2010 with 0,1% and with 1.1% in 2011. But this situation is not encountered in HRST, here it is a growing trend. In 2008 the increase of the HRST was by 4.7%, in 2009 and 2010 was recorded an increase with 2.6% and in 2011 with 5.5%.

The economic crisis from this period has left a mark on broadband penetration rate too, although it records an upward trend, the increases from year to year are dwindling. If in 2008 the rate increased by 80%, in 2009 the increase was 30%, in 2010 12% and in 2011 only 6.8% compared to previous year.

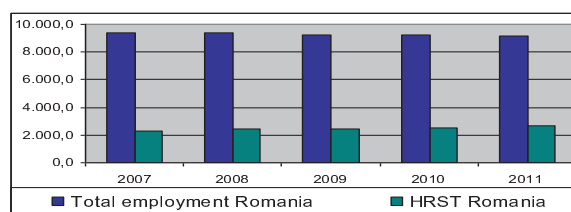
Table nr.2. Dynamics of the HRST and total employment in Romania (% , previous year = 100)

Year	Index Total employment	Index HRST	Index Broadband penetration rate
2007	100	100	100
2008	100,17	104,68	180
2009	98,66	102,52	130
2010	99,96	102,87	111,97
2011	98,90	105,49	106,87

Source: own compilation based on Eurostat figures

The share of HRST in total employment in Romania is increasing by 1% from one year to another, from 24.7% in 2007 reaches 29.4% in 2011, but still much lower than the EU average. This can be seen in Figure nr.1 and Figure nr.2.

Figure nr.1
Dynamics of the HRST and total employment in Romania



Source: own compilation based on Table nr.2

Things are similar also at the EU level, employment in the studied period shows a downward trend and in 2008 the total employment increased by 1.14% and then started to decline, in 2009 by 1.8% compared to previous year and with 0.5% in 2010. From 2011 employment started to slightly grow again by 0.36%.

Table nr. 3. Dynamics of total employment, HRST and broadband penetration rate in European Union (% , previous year = 100)

Year	Index Total employment	Index HRST	Broadband penetration rate	HRST in Total Employment
2007	100	100	16,2	45,50%
2008	101,14	103,18	20,2	46,42%
2009	98,26	102,07	22,7	48,22%
2010	99,51	101,68	24,7	49,27%
2011	100,36	104,72	26,5	51,42%

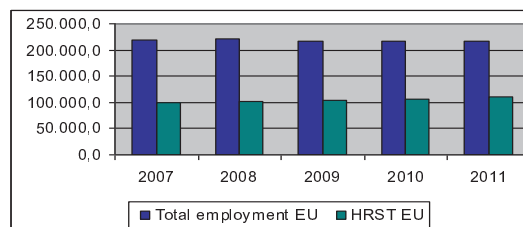
Source: own compilation based on Eurostat figures

HRST have recorded, like in Romania, an upward trend. In 2008 increased by 3.18%, in 2009 by 2%, in 2010 by 1.6% and in 2011 by 4.7% compared to the previous year.

Dynamics of broadband penetration rate can be observed in Table nr.3, it has an upward trend, from 16.2% in 2007 to 26.5% in 2011.

The share of HRST in total employment in the EU recorded an upward trend, increasing in the studied period by 6%, from 45.5% in 2007 to 51.4% in 2011. Its dynamics can be seen in Figure nr.2

**Figure nr. 2
Dynamics of the HRST and total employment in European Union**



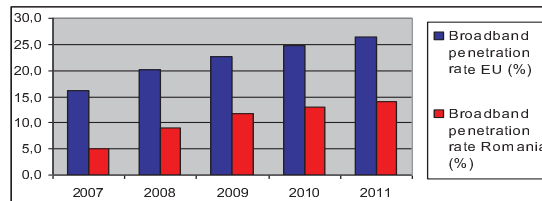
Source: own compilation based on Table nr.1

Even though the broadband penetration rate is increasing in Romania, only a relatively small proportion of the population has access to high speed internet. Unlike most European markets, where broadband services are provided by a dominant company, in Romania supply is

diverse, with a large number of cable operators (Romtelecom, RDS and UPC) and "neighborhood networks"⁴.

Access to broadband infrastructure in Romania is relatively cheap in many urban areas and "Due to the fiber networks these connections also have very high speeds - only 2% of the connections in Romania are below 2 Mbps, 53% of connections have speeds between 2-30 Mbps, 29% have speeds between 30-100 Mbps and 16% of connections have speeds of at least 100 Mbps"⁵

Figure nr. 3
Dynamics of the broadband penetration rate in Romania and EU



Source: own compilation based on Table nr.1 and Table nr.2

Dynamics of broadband penetration rate in Romania and in the European Union can be seen in Figure nr.3. The upward trend is clear, the rate increased from 5% in 2007 to 14% in 2011 in Romania and from 16.2% in 2007 to 26.5% in 2011 in the European Union. The difference between broadband penetration rate in Romania and the average of EU is still high, reaching a difference of 12% in 2011, therefore more aggressive measures are needed to expand the coverage of broadband, especially in rural areas.

Due to the low rate of broadband penetration rate in Romania, its influence on total employment is insignificant, that is the reason the HRST indicator was chosen.

The way in which HRST is influenced by broadband penetration rate was calculated with the aid of a regression, through a unifactorial econometric model with the following form:

$$\text{HRST} = \alpha + \beta * \text{Broadband} + \varepsilon \quad (1)$$

⁴ are private companies, low cost with a small group of customers.

⁵ http://www.itu.int/ITU-D/treg/broadband/BB_MDG_Romania_BBCOM.pdf

(technology and equipment used in telephone networks to ensure access to a high speed digital network on twisted copper wires) at the end of 2005; reduce use of personal computers, a reduce area of broadband services and low income, especially in rural areas.

(2) Broadband penetration rate contributes to employment growth, both as a result of network construction and to the spillovers that have an impact on the whole economy. Implementation programs are focused on construction and telecommunication sector but the impact of the spillovers is higher in financial sector, education and health, which are included in the field of HRST.

(3) Although broadband penetration rate is low compared to the other EU countries, the access to infrastructure is relatively inexpensive in many urban areas and has high speed connexions.

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