Universities—Drivers for regional innovation culture and competitiveness

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Abstract: The actual infrastructure of the information society sustains the globalization trend and increases the importance of the information and knowledge. The development of the knowledge society is the direct consequence of the mix of economic, social and cultural processes, which involve the knowledge creation and its equitable distribution, access and sharing. Universities, as poles of knowledge, creativity and innovation, play a key part in the regional development and the global competitiveness. The universities are active promoters of the innovation culture at the regional and international level, by increasing the synergy among education, research and innovation. The article focuses on the role of the academic area in the development of the learning and creative society at the regional level, contributing to the design of new knowledge and technology embedded products, services and organizational processes, which represent the premises of the global competitiveness. The most important challenge the academic environment faces in the new economy is to bridge the gap between the political decision, the governance and the labour market, offering innovative solutions and developing the intellectual capital to address the various issues of the knowledge economy. The article highlights the role of the universities as regional development drivers, by analyzing the economic performance of the Bucharest-Ilfov region and the direct influence of the trinomial equation: education-research-innovation.

Key words: regional innovation; regional development; human development indicator; sustainable development

1. European framework for the development of the knowledge society

The transition to the knowledge society is the main goal of the Lisbon strategy which integrates the new technological infrastructure, research and innovation, and the life-long learning processes (see Figure 1). The creation of knowledge and the focus on innovation represent the key factors for increasing the competitiveness and ensuring the sustainable growth and a better life standard, as stipulated in the Lisbon and Gotheburg strategies.

> Europe must renew the basis of its competitiveness, increase its growth potential and its productivity and strengthen social cohesion, placing the main emphasis on knowledge, innovation and the optimization of human capital. (European Commission, 2007, p. 29)

The cohesion policy, which has been as main goal balanced the development of the European space, in synergy with the renewed Lisbon strategy focuses on the human resources with increased capacity of innovation.

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The Lisbon indicator, measuring the fulfillment of the Lisbon goals, includes data concerning the level of education, and also the research and development expenditure rate (total level or contribution of business sector, as percent from GDP). This structure (see Table 1) illustrates the importance of the human resources and of the research and development activities in the evaluation of the progress of the European regions and countries.

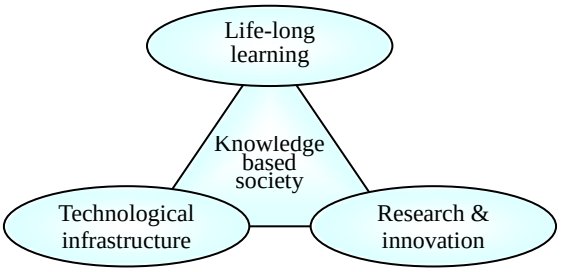

Figure 1 Knowledge based society

Table 1 Main cohesion indicators

Main cohesion indicators	
Population	- total population
	- population density
	- population growth
Economy	- GDP/ person
	- GDP/ person employed
	- GDP growth
	- employment by sector
	- R&D expenditure
	- R&D expenditure in the business sector
Labour market	- employment rate
	- employment rate structure
	- unemployment rate
	- long term unemployment
	- youth unemployment
Age structure	- population per age group
Education	- educational attainment (% from total): - low - medium - high

Source: European Commission (2007, pp. 177-195).

Other important indicator related to the knowledge economy is the EIS (European Innovation Scoreboard). This indicator is structured in five dimensions grouped in input and output innovation indicators, as illustrated in Table 2. The innovation indicators emphasize the role of education, especially the technique education, lifelong learning and R&D, strengthening the relation with the cohesion policy and the Lisbon strategy.

The indicators for monitoring the European sustainable development strategy contain also a set of similar indicators grouped on 10 thematic areas focusing on innovation and employment as economic drivers and on education and access to the labour market as main inclusion indicators, supporting the competitive development of the European regions and countries.

Table 2 EIS indicators

Main groups	Main dimensions	Indicators
A. Input innovation indicators	1. Innovation drivers	1.1 S&E graduates per 1000 population aged 20-29
		1.2 Population with tertiary education per 100 population aged 25-64
		1.3 Broadband penetration rate (number of broadband lines per 100 population)
		1.4 Participation in life-long learning per 100 population aged 25-64
		1.5 Youth education attainment level (% of population aged 20-24 having completed at least upper secondary education)
	2. Knowledge creation	2.1 Public R&D expenditures (% of GDP)
		2.2 Business R&D expenditures (% of GDP)
		2.3 Share of medium-high-tech and high-tech R&D (% of manufacturing R&D expenditures)
		2.4 Share of enterprises receiving public funding for innovation
	3. Innovation and entrepreneurship	3.1 SMEs innovating in-house (% of all SMEs)
		3.2 Innovative SMEs co-operating with others (% of all SMEs)
		3.3 Innovation expenditures (% of total turnover)
		3.4 Early-stage venture capital (% of GDP)
		3.5 ICT expenditures (% of GDP)
		3.6 SMEs using organizational innovation (% of all SMEs)
B. Output innovation indicators	4. Applications	4.1 Employment in high-tech services (% of total workforce)
		4.2 Exports of high technology products as a share of total exports
		4.3 Sales of new-to-market products (% of total turnover)
		4.4 Sales of new-to-firm products (% of total turnover)
		4.5 Employment in medium-high and high-tech manufacturing (% of total workforce)
	5. Intellectual property	5.1 EPO patents per million population
		5.2 USPTO patents per million population
		5.3 Triadic patent families per million population
		5.4 New community trademarks per million population
		5.5 New community designs per million population

Source: MERIT (2006, p. 7).

In other perspective, the human development indicator (HDI) introduced by the United Nations Programme for Development integrates three dimensions as it is presented in the Table 3. The education represents a central point of interest concerning the human development increasing the innovative capacity and the quality of life.

Table 3 Human development indicator

Index	Measure
Longevity (L)	Life expectancy at birth (LE)
Education (E)	Literacy rate (LR)
	Combined gross enrollment ratio (CGER)
GDP (G)	GDP per capita (PPP)

Source: Retrieved from http://www.pnud.org.

At a deeper analysis, it is easy to observe that the main indicators used in various approaches to measure the cohesion level among regions/countries, the innovation capacity and the human development include the education level as important factor of reference. The research and development represent other important area of interest for the actual economic development. Consequently, the analysis reveals the role of the universities for the

development of the intellectual capital, contributing through the educational, research and innovation processes in order to enhance the knowledge based processes (see Figure 2).

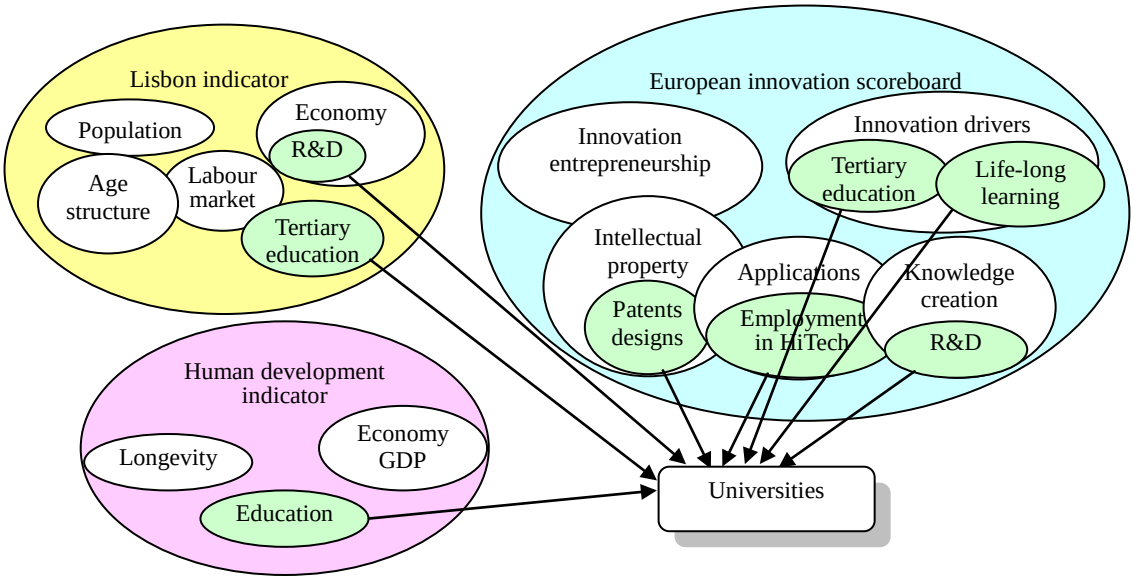

Figure 2 Role of the universities in the knowledge economy

The attainment of the tertiary education (especially the technical and sciences profile) is an important target of the European strategies. Thus the universities are responsible for high level educational services adapted to the socio-economic dynamic.

2. Academic market links

The universities represent the main poles for education and research in the knowledge society, which is in the same time a "learning society". In this new context the academic area offers a real support for the development of new abilities and skills required by the market. The academic system represents in the same time a generator of ideas and good practices emerging from research processes. The findings and valuable research results contribute to the innovative processes at regional, national and international level. Due to the increased importance of the higher education, the actual European strategy has been as main goals the quality and the effectiveness of the educational systems, the enlarged access to education and the development of the open academic European space. Simultaneously the universities participate to the European research area, stimulating the creative processes and the knowledge transfer to the market.

A real challenge for the academic area is to strengthen the relationship with the market actors in order to minimize the gap between the education system and the labour market requirements, revealed as:

(1) Positive gap: The students' skills are more sophisticated and superior than the requirements of the employers;

(2) Negative gap: The students' skills are under the requirements of the labour market.

Under these circumstances, the gap minimization involves not only the efforts from the academic system to cope with the requirements of the continuous changing world, but also a new design of the business process and a great permeability of the employers for new ideas, facts and techniques. This new perspective for the business

environment involves the life-long learning for the management level, in order to design an adequate business and human resource strategy. From this point of view, it is necessary to have a closer link between employers and educational services providers, with a growing emphasis on the interest of the top management of the companies to have a well educated and skilled workforce.

Thus, the gap minimization can be seen as the harmonization between the labour market's needs and the social actors' needs (employers, employees, students and education providers), aiming at reducing both "positive" and "negative" gap. Due to the complexity of the general frame, the both sides: education providers and employers, have to meet the new structural and functional requirements of the new society. Other important conclusion is the need to reinforce the social partnership, in which every actor has to play an active part and to find common solutions. The involvement of the business experts in the tertiary teaching activities, as well as the involvement of the professors and students in the business activities, represent solutions for the amelioration of the theoretical and practical views.

The universities' research activities represent an important bridge pillar between universities and socio-economic environment, contributing to improve the cooperation between academic and business actors. The position of the universities in the trinomial equation education-research-innovation is illustrated in Figure 3. The development of the research networks is linking universities, research institutions, business and governmental entities in a cooperative frame for generating, sharing and using the knowledge ensures the synergy between the academic field and the socio-economic environment.

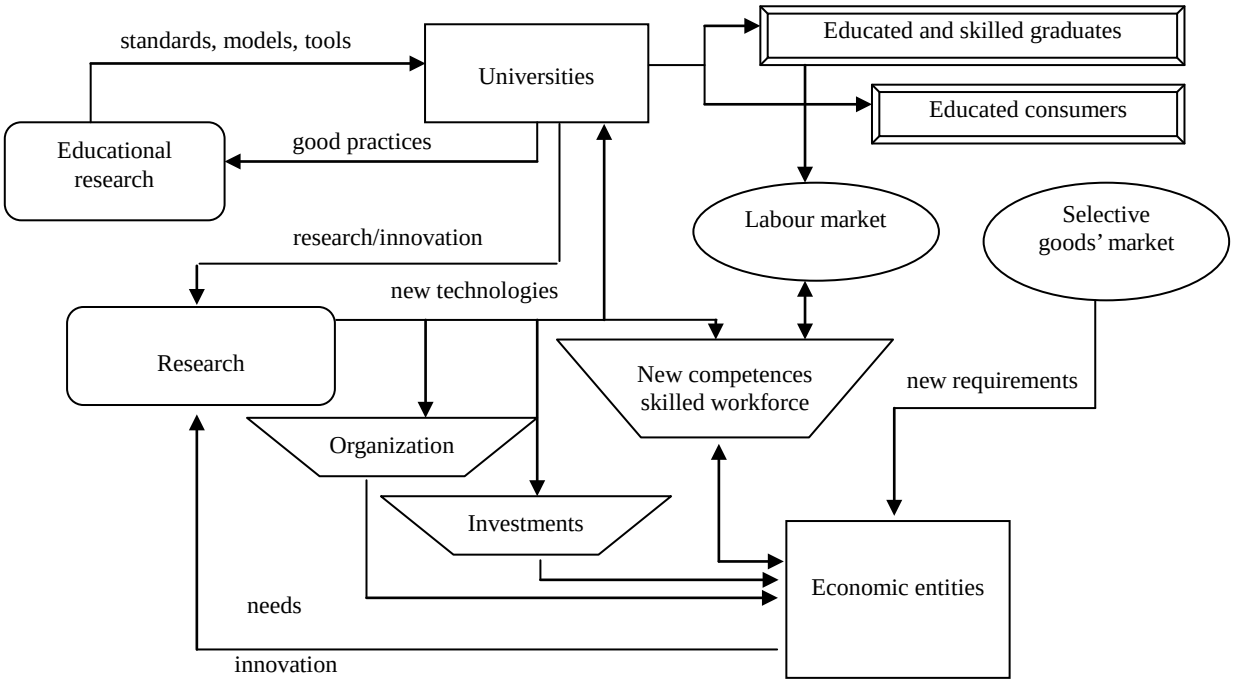

Figure 3 The relationship between academic and socio-economic environment

The universities have a major role in creating a high educated work force more adapted to the changing world and to the requirements of the knowledge economy. The direct relation between the level of education and the employability is revealed in Table 4.

Table 4 Relation between high education rate, employment rate and GDP per capita

No.	Country	High education rate from total, age 25-64, 2005 (%)	Employment rate age 15-64, (%) 2007	GDP per capita in PPS 2007
1	Belgium	31.0	62.0	29,300
2	Bulgaria	21.6	61.7	9,500
3	Czech Republic	13.1	66.1	20,200
4	Denmark	33.5	77.1	30,500
5	Germany	24.6	69.4	28,100
6	Estonia	33.3	69.4	17,900
7	Ireland	29.1	69.1	36,300
8	Greece	20.6	61.4	24,300
9	Spain	28.2	65.6	26,500
10	France	24.9	64.6	27,600
11	Italy	12.2	58.7	25,200
12	Cyprus	28.8	71.0	23,000
13	Latvia	20.5	68.3	14,400
14	Lithuania	26.3	64.9	15,000
15	Luxembourg	26.5	64.2	68,500
16	Hungary	17.1	57.3	15,700
17	Malta	11.4	54.6	19,100
18	Netherlands	30.1	76.0	32,500
19	Austria	17.8	71.4	31,600
20	Poland	16.8	57.0	13,300
21	Portugal	12.8	67.8	18,500
22	Romania	11.7	58.8	10,100
23	Slovenia	20.2	67.8	22,000
24	Slovakia	14.0	60.7	17,000
25	Finland	34.6	70.3	29,000
26	Sweden	29.2	74.2	31,300
27	United Kingdom	29.6	71.5	28,700
	Total UE	22.4	65.4	24,800

Source: Key figures on Europe edition (2009, pp. 19-167).

The analysis demonstrates the interdependence between the education indicator (qualitative variable), an effort indicator (human resources) and a result indicator (GDP per capita). For an accurate correlation, the analysis took into consideration the different evolution in time of the indicators, i.e., the education indicator has an asynchronous relation with the other indicators and its specific values will be provided with a delay of two years (2005 and 2007), meanwhile the human resource and the GDP per capita are synchronous indicators.

Using the simple correlation by analyzing the data concerning the level of education (high education rate), as independent variable, and the employment rate, as dependent factor, we obtained a correlation of 0.6233 and a determination coefficient of 38.85, which demonstrates the direct and strong relation between these indicators. The other indicators of simple correlation are presented in Table 5. The relation between the level of education and the GDP/person is not so intensive.

Table 5 Simple correlation and determination coefficient

Indicator	$r_{x2/x1}$	$r_{y/x2}$	$r_{y/x1}$
Simple correlation	0.66677	0.34758	0.42692
Determination coefficient (%)	44.46	12.08	18.26

Source: Calculated data: X_1-high education rate from total (%), age 25-64, 2005; X_2-employment rate (%), age 15-64, 2007; Y-GDP/person, 2007.

Using a multiple correlation $R_{y/x_1,x_2}$ (Biji, 2002, p. 256) based on the results of the simple correlation presented in Table 5, we have obtained a correlation coefficient of 0.71443 and a determination coefficient of 51.041% which demonstrates the influence of the two factors (level of education and employment rate) on the GDP/person indicator.

In conclusion, the demonstration concerning the influence of the tertiary education indicator on the employability and on the GDP/person indicator emphasizes the role of the universities in the socio-economic environment, as high level educational providers.

3. The role of the academic area in the Bucharest-Ilfov region

The Bucharest-Ilfov region includes the capital and the county Ilfov surrounding the city. The Bucharest-Ilfov region accounts for 2,225,932[1] inhabitants, of which 1,931,838 in Bucharest and 294,094 in Ilfov (at 01/07/2007). Bucharest is the most important Romanian centre for university studies, counting 34 higher education institutions, 184 faculties in the scholar year 2006-2007 (National Statistics Institute, 2009/1, pp. 400-407), a significant number of libraries and academic, national and international research centres. The total number of students was 41,862 in the school year 2006-2007, representing 20.7% of the total school population (of which, 21.85% graduated in science-mathematics-computing and engineering-manufacturing-construction), and the number of teaching staff in the higher education was 10,393 persons in the same year. The data related to the tertiary education in Bucharest demonstrate the great potential of the region concerning education and research. The growth rates of the region, its competitiveness and also its attractiveness consist especially in the capacity of the region to produce knowledge and well educated work force. This is a direct consequence of the intense and fertile activity of the universities, as higher education service providers and as poles for research and innovation.

Bucharest-Ilfov represents an engine for job creation in the framework of the Romanian labour market. In the year 2005, the rate of people with higher education attainment level represented 25.4% from the total population aged 25-64, which is the highest level in Romania (average 11.7%) and a score superior to the European average of 22.4%. A strong link exists between human capital and productivity in business. Investment in human capital increases productivity and is a direct source of innovation and long-term competitiveness. According to the statistical data and with the actual trend, Bucharest-Ilfov region has a positive evolution due to its skilled work-force. The position of the Bucharest-Ilfov in the European landscape is illustrated in Table 6.

According to the statistical data, there is a strong correlation between the high education attainment and the Lisbon indicator (0.545) and a direct influence of the education in fulfilling sustainable development goals, as demonstrates the determination coefficient (29.7%).

[1] Source: Territorial Statistics (2009), National Statistics Institute, Bucharest.

Table 6 High education rate, employment rate, GDP/person and Lisbon indicator

No.	Regions of European capitals	High education rate from total, age 25-64, 2005 (%)	Employment rate, age 15-64, 2005 (%)	GDP/person (%, index EU 27=100)	Economic Lisbon indicator (EU 27) 2004-2006
1	Region de Bruxelles	41.5	54.8	248.3	0.50
2	Yugozapaden	31.5	61.5	49.1	0.45
3	Praha	27.1	71.3	157.1	0.82
4	Danmark	33.5	75.9	124.5	0.83
5	Berlin	34.6	58.5	101.2	0.45
6	Eesti	33.3	64.5	55.7	0.54
7	Southern and Eastern (Ireland)	31.2	68.2	156.5	0.79
8	Attiki	25.3	61.4	112.7	0.57
9	Comunidad de Madrid	36.6	68.5	132.1	0.68
10	Ile de France	37.7	64.2	174.5	0.76
11	Lazio	16.4	58.5	131.8	0.57
12	Kypros	28.8	68.5	91.4	0.63
13	Latvija	20.5	63.3	45.5	0.45
14	Lietuva	26.3	62.6	51.1	0.50
15	Luxembourg	26.5	63.6	251.0	0.67
16	Közép-Magyarország	26.6	63.3	101.6	0.61
17	Malta	11.4	53.9	74.4	0.27
18	Noord-Holland	36.2	73.7	153.7	0.73
19	Wien	23.4	63.8	179.7	0.69
20	Mazowieckie	23.5	57.6	76.8	0.43
21	Lisboa	20.1	66.8	105.8	0.48
22	Bucureşti- Ilfov	25.4	59.3	64.5	0.39
23	Slovenija	20.2	66.0	83.3	0.55
24	Bratislavski	28.4	69.6	129.3	0.71
25	Manner-Suomi	34.7	68.4	115.3	0.79
26	Stokholm	37.3	74.9	165.7	1.000
27	London	36.7	67.3	188.5	0.75

Source: European Commission (2007, pp. 177-195).

Table 7 Basic indicators related to HDI

Region	Average life period (years) 2005-2007	Literacy rate (%)	Combined gross enrollment ratio (%)	GDP per capita (PPS) 2006
Nord-Est	71.78	94.1	72.0	5,628.0
Sud-Est	72.66	95.5	71.0	7,979.3
Sud	72.50	95.0	70.0	6,785.6
Sud-Vest	72.49	96.4	71.6	6,758.6
Vest	71.89	98.1	80.0	9,345.1
Nord-Vest	71.76	97.2	78.0	7,869.1
Centru	72.89	97.8	71.1	8,444.4
Bucureşti-Ilfov	74.15	99.5	86.1	15,466.0
România	72.61	96.3	76.0	8,100.0

Source: National Statistics Institute (2009).

Other interesting perspective on the sustainable development focused on the human development reveals also

the role of the education. In addition, a benchmarking analysis taking into account the development Romanian regions underlines the contribution of the education level in the human development index. The indicators integrated in the Human Development Index (HDI) for the 8 Romanian development regions are presented in Table 7.

The specific indexes (life expectancy—ILE, education—IE and GDP—IGDP) are calculated and illustrated in Table 8.

Table 8 Specific indexes in Human development

Romanian regions	ILE	IE	IGDP per capita	HDI
Nord-Est	0.780	0.868	0.672	0.773
Sud-Est	0.778	0.874	0.730	0.794
Sud	0.776	0.867	0.703	0.782
Sud-Vest	0.777	0.882	0.703	0.787
Vest	0.766	0.921	0.757	0.814
Nord-Vest	0.766	0.908	0.729	0.801
Centru	0.784	0.889	0.740	0.804
Bucuresti-Ilfov	0.814	0.950	0.841	0.868
Romania	0.779	0.896	0.733	0.802

Source: Calculated data using National Statistics Institute (2009/1) and (2009/2).

The education index is the highest in the Bucharest-Ilfov region (0.95) according to the position of the capital in the Romanian educational system.

The contribution of each factor in the human development index is revealed in Table 9, and demonstrates that the education plays the key role for the human development for each region and scores the greatest rate for Bucharest-Ilfov region.

Table 9 Contribution of each factor in Human development

Region	Demographic factor (%)	Educational factor (%)	Economic factor (%)
Nord-Est	33.62	37.41	28.97
Sud-Est	32.66	36.69	30.65
Sud	33.08	36.96	29.97
Sud-Vest	32.90	37.34	29.76
Vest	31.34	37.68	30.97
Nord-Vest	31.88	37.79	30.34
Centru	32.49	36.84	30.67
Bucureşti-Ilfov	31.25	36.47	32.28
Romania	32.35	37.21	30.44

Source: Calculated data.

4. Conclusion

The tertiary education and the RDI activities represent the core of the knowledge economy and emphasize the roles of the universities in the process of increasing the competitiveness and ensuring a better life standard.

The comparative analysis between EU countries and European capital development regions revealed the importance of the tertiary education, i.e., the roles of the universities. The analysis of the Bucharest-Ilfov data and the correlation between the educational level and the economic development indicators underlined the

contribution of the tertiary education for the employment rate and for the sustainable development at the regional, national and individual level. The focus on the human development in the sustainable development perspective is illustrated by the HDI and demonstrates that the education level is very important for the quality of life, contributing to an increased accessibility on the labour market and to the personal satisfaction and self-confidence.

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