Bio-Economy Development in Romania

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Abstract

The global crisis defined by the crisis of energy, ecology and the biosphere, and the environment requires solving the economic problem, satisfying a growing set of needs, given the limited and insufficient resources. Bioeconomy should be the bases for all economic activities and unlimited economic growth must be compatible with the fundamental laws of nature.

The research aim is to emphasize the benefits of the dynamics of the intellectual capital on the evolution of the bioeconomy. In the analysis is used multiple regression to study the established link between bio economy and a number of factors that may measure the intellectual capital, such as: Market Capitalization of Bitcoin, Patent applications and the Turnover from Innovation at Romanian level. The research concludes that bioeconomy is influenced most by the number of Patent applications to the European Patent Office. The progress of bio-economy cannot be achieved without the harness of intellectual capital.

Key words: Market Capitalization of Bitcoin, Patent applications listed by European Patent Office, Turnover from Innovation, Energy intensity of economy

J.E.L. classification: O11, B22

1. Introduction

The balance between man and the environment has been broken by technological progress, economic development and the demographic explosion. The law of action and reaction speaks its word. Albert Arnold Gore, the 45th Vice President of the Unites StateS of America, was talking about an environmental holocaust in what Karl Popper, considered to be one of the greatest science philosophers in the twentieth century, considers as an effect of disregarding nature namely the loss of the sense of piety for nature (Ross, 2013). The concept of "bio-economy", according to Bonaiuti, who used the concept at the end of the 1960s, represented an appropriate economic order that underpins all economic activities (Bonaiuti, 2015).

The European Commission has begun to promote this concept much in recent years. One of the most important actors in this effort was Patermann, who was the program director of "Biotechnology, Agriculture and Nutrition" at the European Commission's Directorate-General for Research, Science and Education. The first Global Bio-economic Summit took place in Berlin in 2015. Bioeconomy has gained great significance in last years as a wide range of benefits have been detected by several countries (Patermann, 2018). Intellectual capital in the current economy becomes the new core of economic development, because the impact of financial assets and fixed assets is clearly inferior to the impact sustained by knowledge (Preda, 2013). Reliable measurement of this one has become a major research area for practitioners and researchers since the early 1990s. There are a lot movements in this area, such as circular economy, the green economy and bioeconomy.

Providing the transfer of knowledge at an advanced and rigorous level will give to the exponential increase in the quality of human resources (Staffas et al., 2013). Therefore, the findings of the bioeconomy launches extensive evolutionary processes that require a comprehensive approach where knowledge economy plays a significant role (Birner, 2018). Intellectual property is the currency of research and technology transfer nowday, especially in the form of patents.

The high quality of intellectual capital can provide and motivate the improvement of human capital and the generation of new knowledge for the realization of a sustainable bio-economy (Dumay, 2009).

In bioeconomy, knowledge is the most important intangible asset, and intellectual property is the currency of exchange so creating value in knowledge depends on access to intellectual property rights (Edvinsson and Malone, 1997).

The research scope is to emphasize the benefits of the dynamics of the intellectual capital growth on the evolution of bio-economy. Therefore is studied the established link between the Energy Intensity of the Economy (IEE) and a number of factors that can measure the intellectual capital, namely the stock market capitalization of the Bitcoin digital coin (MkCapBTC), Patent applications listed by European Patent Office (CB) and the Turnover from Innovation (CA). The data were taken from the Eurostat European Statistics. The study is based on data between 2015 and 2017.

General hypothesis: The evolution of bio-economics is influenced by intellectual capital;

H1: There exists a considerable link between the IEE and the MkCapBTC;

H2: Between the IEE and the CB there is a considerable link;

H3: There exists a considerable link between the IEE and the CA_INV.

The results of our analysis coincide with those of the authors Gârdan, Andronie, Iatagan, and Hurloiu, namely in a knowledge based economy, the link between sustainable bioeconomy and companies is achieved by Intellectual Capital. At Romanian level the bioeconomy is influenced most by the number of Patent applications to the European Patent Office in proportion of 81%. The indicator proposed influences the bioeconomy. Therefore we may believe that the progress of bio-economy cannot be achieved without the harness of intellectual capital.

2. Literature Review

The developments in the bioeconomy sphere should reflect their usefulness regarding the provision of sustainable solutions for future competitiveness growth by using natural resources. Latterly the relevance of education and research in bioeconomy area is obvious because these types of solutions which may be generated mainly by educated individuals who contribute to the better specialization of the human capital on this market. The scope of a lot research is to analyze the influence of universities upon the human capital activating in the bioeconomy sectors throughout the transfer of three types of knowledge: rational, emotional and spiritual. The data obtained capture the facets of intellectual capital in interdependence and interrelation with the dimensions of bioeconomy. The studies can be a starting point to designing strategies for increasing the human capital of organizations in various fields as well as of systems in the bioeconomy field.

The world nowday faces many challenges that may be solved by using the principles of bioeconomy. Bioeconomy had a multi-disciplinary approach with the objective of an integrated scope, namely, to achieve sustainable development. In a knowledge based economy, the link between sustainable bioeconomy and companies is achieved by Intellectual Capital. The intangible assets of Intellectual Capital coming from the external environment of a company in the shape of Relational Capital have great value, as they can offer competitive advantages. The dependency between the intellectual capital and the financial performance of biotechnological (biotech) companies is analyzed also throught the article Intellectual capital and financial performance of biotech companies in the pharmaceutical industry . The analysis was performed for 24 biotech companies during 2002-2014, on several indicators available on the Thomson Reuters database. The financial performance was measured through the return on assets, return on equity and the debt-to-equity ratio. In order to capture the intellectual capital, the focus was on a designing a new indicator, proposed by the authors, respectively the efficiency of research and development expenditures, along with another proxy, previously attested by the literature and reflected through the market to-book ratio. The research methodology belonged on applying the correlation method, regression, and structural equations modelling. The results revealed a significant negative relationship between ROA, ROE and MTB, which contradicts the literature and suggests that, for this particular type of companies, MTB wasn`t relevant to express the intellectual capital. MTB was

positively correlated with DE indicator. When they used the ECD, the results attested a strongly positive and significant relation with ROA and ROE, and a negative one with DE. Therefore, the applied tests confirm ECD as the most suitable indicator to appreciate the intellectual capital for the biotech companies in the pharmaceutical industries (Anghel et.al., 2018).

The paper of Vătămănescu, E.M., Alexandru, V.A., Cristea, G., Radu, L., Chirica, O., aims to address a demand side perspective of bioeconomy by laying emphasis on the digitalization of markets and, subsequently, on the consumption patterns at the macroeconomic scale (Vatamanescu et. al., 2018). The study investigate the influences of intellectual capital on the consumption patterns through the lens of bioeconomy. The scope is set on the bio products consumption in two European countries relying on a sample of over 700 active online consumers. Processed through an equation modeling technique, the data indicated the existence of significant influences among the considered variables. Another article, Bioeconomy development and using of intellectual capital for the creation of competitive advantages by Smes in the field of biotechnology, aims to present the perceptions and opinions of the managers of small and medium enterprises in applied biotechnology on the importance of intellectual capital and the application of knowledge management principles to create and maintain competitive advantages (Gardan et.al., 2018). Companies that develop a sustainable knowledge management system that they integrate into their marketing strategy have the most prominent position on the market and gain multiple competitive advantages. The research reflect that the strategic decision regarding the implementation of a knowledge management system and the intelligent use of intellectual capital resources are correlated with variables such as: the managers' level of education in the field, corelating managers' activity to organizational culture. Knowledge, for new business models, is a good asset that can be capitalized; from this perspective, the implications at the level of marketing strategies are in the same time diverse and complex.

At the base of the transformations taking place in the economy, knowledge will be found under different circumstances - raw material, production factor or finished product, thus, economic processes will in fact transform and adapt to change and new demands through knowledge (Nicolescu, 2011)..

The conclusion from the revision of the literature is that knowledge management and intellectual capital are indissolubly linked to the application of the principles of the knowledge-based economy, which are also the basis for the current evolution of bioeconomy.

3. Materials and Methods

The European Commission through its statistical database defines intellectual capital through the following indicators that can influence the bio-economy: R&D personnel by sector, Patent applications to the European Patent Office, Turnover from innovation, Graduates by education level and Labor status by educational attainent level. The analysis is based on the indicators: Patent applications listed by European Patent Office (CB) and Turnover from innovation as a percentage of Total Turnover (CA_INV) because they contain in database, data during the analyzed period 2015 – 2017 for Romania country. Although intellectual capital can now be considered somewhat abstract, in the economy, the concept of intellectual capital is defined as an estimate of a person's ability to produce income through work (Pop and Valeriu, 2015). Intellectual capital is considered a hidden treasure to help companies, the economy and, implicitly, bio-economy to develop in this age of technology and knowledge, therefore is why we proposed our indicator of measuring the intellectual capital (human capital), the Bitcoin's Market Capitalization (MkCapBTC). In the analysis we will see if the indicators identified in the literature influence the development of the bioeconomy more than the indicator proposed by us. The tools and methods of analysis used in the study are: the collection of the value of each indicator by the method of observation, sorting and grouping of data; creating graphs using the Excel spreadsheet program in the Microsoft Office 2010 package for identified indicator values and and then sorting them for 3 years; statistical analysis using ANOVA, SPSS 19.0, and Pearson correlation indices. In the regression analysis we used those indicators mentioned above as independent variables and as the dependent variable we used the variable Energy Intensity of the Economy. As the analysis tracks the inflow of intellectual capital on the bioeconomy,

the indicators defining the bioeconomy will be dependent variable. ANOVA may use a single variable as a dependency. That is why we extracted from the European Commission database only the values of the indicator Energy Intensity of the Economy because it contains values at the level of Romania for all 3 analyzed years.

Considering intellectual capital as a key resource for the expansion of organizational intelligence, economic growth and especially for the development of bio-economics, we have used the following objectives for analysis:

- O1: Determining the link and the percentage in which MkCapBTC influences the IEE;
- O2: Determining the link and the percentage in which the CB influences the IEE;
- O3: Determining the link and the percentage in which the CA_INV influences the.

Hhypothesis 0: The evolution of bio-economics is influenced by intellectual capital;

- H1: There exists a considerable link between the IEE and the MkCapBTC;
- H2: Between the IEE and the CB there is a considerable link;
- H3: There exists a considerable link between the IEE and the CA_INV.

Regression shows how a variable is dependent on another variable. The equation of the regression model is expressed as follows (1):

$$IEE = \beta 0 + \beta 1*MkCapBTC + \beta 2*CB + \beta 3*CA\_INV + \varepsilon$$

3. Results

It is noted that the most significant link is between the Energy Intensity of the Economy and the number of Patent applications to the European Patent Office (Table 1). Between the dependent variable - the Energy Intensity of the Economy - and the independent variable - the number of Patent applications to the European Patent Office - there is a strong direct link, the value of the correlation coefficient is + 0.810, with a Sig. value less than 0.05.

Table no. 1. The link that exists between variables at the Romanian level (processing data using the SPSS 19 statistical program)

Correlations					
		IEE	**MkCapBTC**	**CB**	**CA_INV**
Pearson Correlation	IEE	1.000	-.526	.810	.732
	MkCapBTC	-.526	1.000	-.632	-.997
	CB	.810	-.732	1.000	.779
	CA_INV	.732	-.897	.779	1.000
Sig. (1-tailed)	IEE	-	.011	.021	.008
	MkCapBTC	.011	-	.024	.027
	CB	.024	.024	-	.021
	CA_INV	.027	.027	.0216	-
N	IEE	3	3	3	3
	MkCapBTC	3	3	3	3
	CB	3	3	3	3
	CA_INV	3	3	3	3

Source: Author's contribution

Table 2 highlights the fact that 92% of the variation of Energy Intensity of the Economy can be explained by the influence of independent variables.

Table no.2. The percentage of the link between the variables at Romanian level (own processing data using the SPSS 19 statistical program)

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.926b	.915	.605	3901.4513
2	.797c	.903	.701	4134.5846
3	.738d	.821	.665	1227.6021
a. dependent variable: IEE; b. independent variables: MkCapBTC, CB, CA_INV; c. independent variables: CB, CA_INV; d. independent variables: CB.				

Source: Author's contribution

The correlation coefficient (R) increases as many variables are introduced into the model. Model 1 analyzes the correlation between all the variables included in the study. Model2 and 3 eliminate the variables in order of the weakest influence: MkCapBTC and CA_INV, respectively (see Pearson coefficient in Table 1).

The equation of the regression model according to the data presented below is the following: IEE = 841.328 + 12.305*MkCapBTC + 43.136*CB + 32.034*CA_INV

The Regression coefficients are as stated in Table 7, e.g. β0 = + 841.328; β1 = + 12.305; β2 = + 43.136; β3 = + 32.034.

Table no. 3. The Regression coefficients at Romanian level (own processing data using the SPSS 19 statistical program)

Coefficientsa							
Model 1	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig**	**Collinearity Statistics**	
	β	**Std. Error**	**β**			**Tolerance**	**VIF**
(Constant)	841.328	414.03	0.000	0.000	0.000	0.000	0.000
CB	43.136	0.001	0.46	0.21	0.019	0.377	1.343
CA_INV	32.034	231.00	0.67	0.29	0.023	0.298	1.533
MkCapBTC	12.305	446.24	0.27	0.21	0.013	0.178	0.874
a. dependent variable: IEE; independent variables: CB, CA_INV, MkCapBTC.							

Source: Author's contribution

The model reflects the influence of the evolution of the number of Patent applications to the European Patent Office, the Turnover from innovation and the stock market capitalization of the Bitcoin digital coin on the Energy Intensity of the Economy at the level of Romania. From the analyzed model a few ideas are drawn:

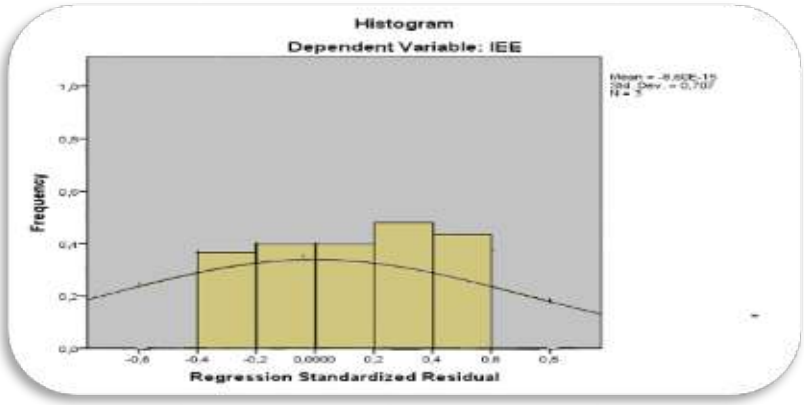
• if we keep constant the Turnover from innovation and the value of Market capitalization of the Bitcoin, a percentage increase in the number of Patent applications listed by European Patent Office leads to an increase in the Energy Intensity of the Economy by 43 percent;

• if we maintain constant the number of Patent applications listed by European Patent Office and the value of Bitcoin's stock market capitalization, a percentage increase in Turnover from innovation leads to an increase in the Energy Intensity of the Economy by 32 percent;

• if we maintain constant the value of turnover from innovation and the number of Patent applications listed by European Patent Office, a percentage increase in the value of Bitcoin's stock market capitalization leads to an increase in the Energy Intensity of the Economy by 12 percent.

Compliance with the hypothesis required by the regression analysis can be graphically checked using the histogram in Figure 1.

Figure no. 1. Verifying the normality of the research through the histogram (own processing data using the SPSS 19 statistical program)



Source: Author's contribution

4. Conclusions

The intellectual capital of an organization can be successfully exploited through appropriate management strategies, these influencing the transformation of the intellectual capital potential into the operational intellectual capital (results that increase the value of the organization). The benefits of optimal management of an company's intellectual capital are numerous and generate an irreversible evolution on the scale of knowledge. Cause the field of bioeconomics is a new and extremely complex one, it requires an advanced knowledge base on different niches. The global crisis characterized by the crisis of the ecology and the biosphere, and the environment requires solving the economic problem, satisfying a growing set of needs, given the limited and insufficient resources. Bio-economy must be the base for all economic activities and unlimited economic growth should be compatible with the fundamental laws of nature.

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The results of our analysis lead to the conclusion that research and innovation play an important role in the evolution of bio-economy at the level of Romania. Intellectual capital is the currency of research and technology transfer, especially in the form of patents. The creation of research

alongside bioeconomic innovation is conditioned by the existence of quality universities. Collaboration between institutions and the economy may increase the quality of innovation.

The European Union has recognized universities as an essential resource for innovation by offering to support such activities (Kuttenkeuler, 2018).

Romania has a great potential to develop an economy based on the concept of bio, because it is a country endowed with a wide variety of natural resources (forests, natural gas, fertile agricultural land - 7.5% of the agricultural area used in the EU - lignite, crude oil, salt, minerals, silver, gold and hydrological networks).

The two-way link between universities, knowledge creators and the economic environment, the knowledge user and the resource generator can be synthesized from the perspective of the development of the Romanian bioeconomy in different ways: transfer of knowledge to enterprises or experimental functional research for products, technologies, methods, services, as well as significant improvement in the fields of intelligent specialization (EU, 2012, and OECD, 2009).

A bio economy should be strongly based on academic research. A strong academic environment may guarantee the existence and management of the resources needed for complex, laborious and expensive research, development and implementation. Starting from these arguments transposed in the context of Romania, the article supports the idea that the relationship between intellectual capital and bioeconomy is the key to progress in the field.

The contribution of this paper to the literature is:

- inclusion of the Bitcoin variable in the analysis besides the variables included in the literature
- proposing to support the research activity of universities as a solution for the development of bioeconomy.

The analysis leaves room for further interpretations and future research because the study was only conducted for a period of 3 years and only at the level of Romania

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