The Role of Universities in Cluster development of Countries' Economy

OLEKSANDR LEVCHENKO[1] – ILONA TSARENKO[2]
[1,2] *Central Ukrainian National Technical University*
Ukraine

Abstract

The paper deals with the issue of cluster development. We analyze and asses the linear relation between cluster development and independent variables such as university ranking, according to the Global Talent Competitiveness Index. The aim of this paper is to highlight the relationship between university ranking as an indicator of the evaluation of level of higher education of country and cluster development. For the purposes of this paper, the analysis of these indicators of 75 countries of the world. With regard to the aim, we have set the following hypothesis: we assume that there is a statistically significant correlation between the impact of university ranking and cluster development of country. We provide mentioned analysis by multidimensional regression analysis for the year 2017 of 75 countries of the world. The analysis confirmed that the cluster development has notable relationship with university ranking of country.

Keywords: Knowledge-based economy, University, Economic development, Cluster development, Regional development, Innovative model of economy.

JEL Classification: O1, O3, O52, P46

1 Introduction

During the first decades of the 21st century, the developing countries have achieved the certain results and now are making more and more their efforts of reducing the economic gap that exists between them and the developed countries. The Asian countries demonstrate a success in these directions too, first of all, Singapore, China and Korea. A number of European countries, such as Sweden and Denmark, are already achieving consistently the high economic indicators in due to the targeted state programs, which are oriented on the formation of knowledge based economy, which is actual at the current stage in dimension of innovation model of economies. That's why, the continuing of modernization of their economies on the basis of innovative technologies remains a key aim of the state policy of these countries, that is one of the challenge at the current stage. And to help to meet the challenges of globalization, pressure on limited resources and an aging population, the EU has launched the Europe 2020 strategy for smart, sustainable and inclusive growth, where one of the three priorities is to develop an economy based on knowledge and innovation, this involves improving the quality of education, strengthening research performance,

[1] prof., Dr. Oleksandr Levchenko; Central Ukrainian National Technical University, prospect Universytetskyi, No. 8, 25006, Kropyvnytskyi, Ukraine, om_levchenko@ukr.net
[2] Phd Student Ilona Tsarenko; Central Ukrainian National Technical University, Faculty of Economy and Management, Department of Economics, Management and Commercial activity, prospect Universytetskyi, No. 8, No., 25006, Kropyvnytskyi, Ukraine, ilonka.tsarenko@gmail.com

and promoting innovation and technology transfer throughout the EU (European Commission Communication, 2014).

The researches of leading scientists allow us to conclude that in the issue of formatting of a knowledge-based economy, a key role belongs to the regional development of the national economy, which is based of innovative-integrated structure, in particularity on clustered structures. In these conditions, the educational institutions become more influential as a center of generating a new knowledge and idea. In addition, according to the survey in The Economist suggests the conception of the knowledge-based economy "portray(s) the university not just as a creator of knowledge, a trainer of young minds and a transmitter of culture, but also as a major agent of economic growth: the knowledge factory, as it were, at the center of the knowledge economy" (David, 1997). Closely related to this is the idea that universities can also jump start the emergence of dynamic regional clusters of firms and thus act as crucial contributors to regional economic development (Wolfe, 2005).

According to most cluster theories, businesses are at the core of competitive clusters, with universities and other institutions forming a critical support infrastructure for continued industrial innovation and productivity growth (Feser, 2009; Mura, & Machová, 2015).

According to Cooke et al. (2007), knowledge organizations such as universities and research institutes, as well as businesses involved in innovative activities are usually concentrated in a few specific regions or urban areas, and are not evenly spread across geographical space. However, the contribution of universities to regional development, in general, and to innovative regional cluster set-ups, in particular, is very difficult to measure.

Universities are one such "regional factor" that impacts all of the dimensions of cluster competitiveness. On the one hand, universities are an asset that increases the quality of inputs and producers, by upgrading human capital and disseminating knowledge. Universities also promote economic diversity. In fact, the key role of the university is not so much to grow the economy, as it is to diversify it by generating new opportunities out of the old. The university is the creative side of economic destruction (Gradeck, 2004).

System of higher education institutions is becoming not only a producer of educational services and a new knowledge to its customers (which has the own centers, powerful scientific centers and laboratories, where able to attract students of such universities), but also as their consumers through the creation the powerful research centers in such universities that are actively involved to the introduction of innovation in different spheres of economy and innovation activities (Levchenko et al., 2017). Thus, universities are not just generators of commercializable knowledge or even highly qualified research scientists; they provide other equally critical mechanisms of knowledge transfer (Bramwell, 2008).

Universities generate and attract talent, which contributes both to the stock of tacit knowledge in the local economy, as well as to the 'thickness' of the local labour market (Florida, 2002; Betts & Lee, 2005). Besides, in addition to the conduct of basic research, universities provide both formal and informal technical support, as well as specialized expertise and facilities for on-going, firm based R&D activities (Grossman et al., 2001; National Academy of Engineering, 2003; Mowery et al., 2004). Also, universities act as a conduit enabling firms to access knowledge from the 'global

pipelines' of international academic research networks (Bathelt et al., 2004; Lawton Smith, 2003a; OECD, 1999). Finally, rather than acting as 'ivory towers' insulated from their community, they can function as 'good community players' that support firm formation and growth by facilitating tacit knowledge exchange among networks of innovative firms and acting as 'anchors of creativity' that sustain the virtuous cycle of talent attraction and retention (Wolfe, 2005a; Henton et al., 1997; Gertler & Vinodrai, 2005; Betts & Lee, 2005; Hajdu, Andrejkovič, & Mura, 2014).

The aim of this paper is to highlight the relationship between university ranking as an indicator of the evaluation of level of higher education of country and cluster development. For the purposes of this paper, the analysis of these indicators of 75 countries of the world. With regard to the aim, we have set the following hypothesis: we assume that there is a statistically significant correlation between university ranking and cluster development of country.

2 Methods

The research's methods comprise mainly descriptive statistic tools. The relationship between cluster development of country and selected variable – University ranking (as indicator of quality of higher education of country) – representing the resources were analysed using Pearson correlation coefficient. The significance of correlations was tested with T-student's-test. Indicators have been selected from INSEAD Database, for the year 2017. The analysis has been carried out using Statistica Package and R.

3 Cluster development and University ranking: statistical analysis

To quantify the strength of the relationship, we can calculate the correlation coefficient. In algebraic notation, if we have two variables x and y, and the data take the form of n pairs, then the correlation coefficient is given by the following equation:

$$r = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \sum_{i=1}^{n} (y_i - \bar{y})^2}} \qquad (1)$$

where $\bar{x}$ is the mean of the x values, and $\bar{y}$ is the mean of the y values.

This is the product moment correlation coefficient (or Pearson correlation coefficient). The value of r always lies between -1 and +1. A value of the correlation coefficient close to +1 indicates a strong positive linear relationship (i.e. one variable increases with the other). Further, according to our hypothesis, calculate the degree of relationship between Cluster Development and University Ranking, taking into account the indicators of countries of the world according to the annual report of Global Talent Competitiveness Index.

A correlation coefficient shows the degree of linear dependence of x and y. In other words, the coefficient shows how close two variables lie along a line. In our occasion, y (Cluster Development) is dependent variable and x (University Ranking) - independent variable.

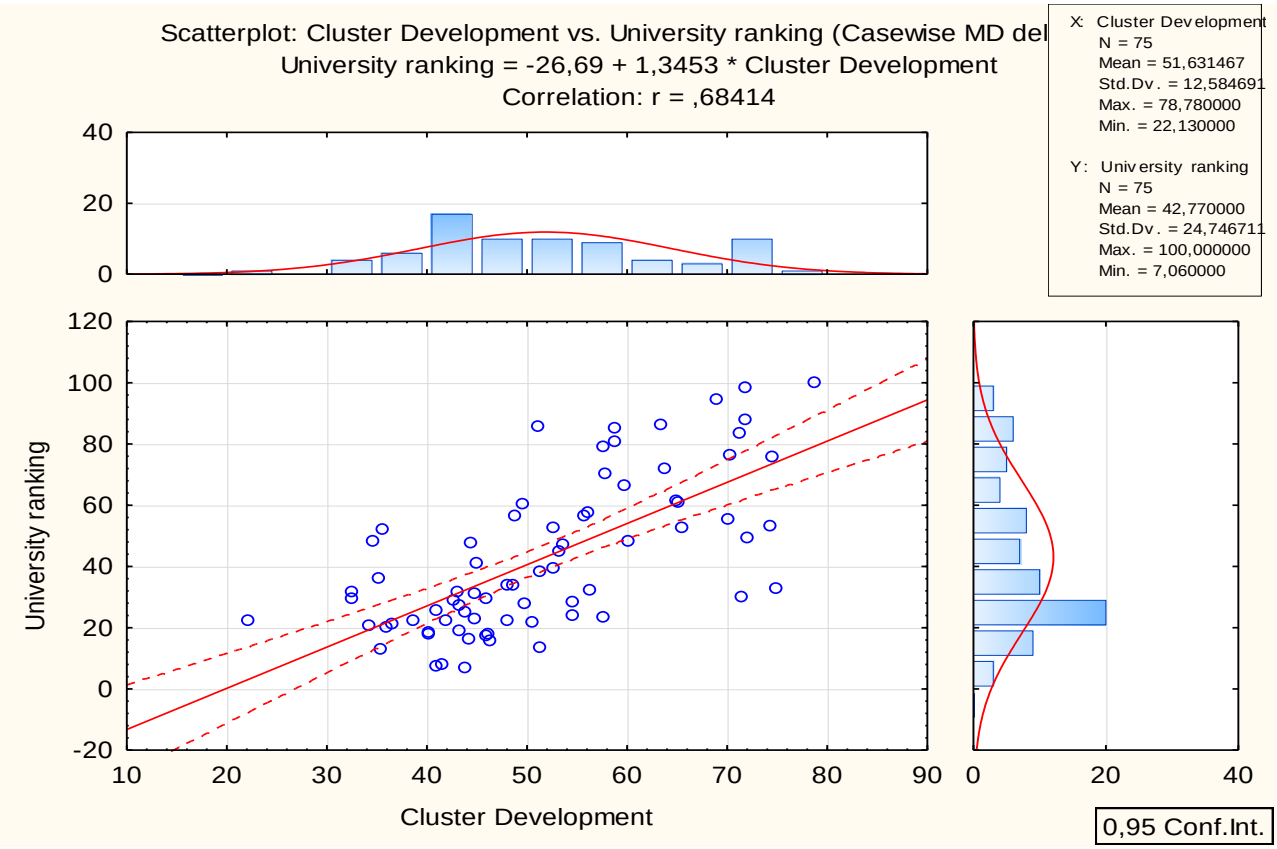

Figure 1 The ratio of correlation between Cluster Development and University Ranking
Source: Authors' own elaboration

The relationship between cluster development and university ranking depicted in Figure 1 has a notable correlation of 0.68. Besides, we can see, that mean value of cluster development is 51.63. The lowest value of cluster development among the countries is 22.13 score (minimum), the highest is 78.78 score (maximum). The highest value is on 56.65 score higher than the lowest value (dimension). The standard deviation is 12.58. Consequently, the variance, the square of the standard deviation, is (12.58) * 2 = 25.16. The asymmetry and the coefficient of variation are given with the corresponding standard errors. The mean value of university ranking is 42.77. The lowest value of university ranking among the countries is 7.06 score (minimum), the highest is 100.00 score (maximum). The highest value is on 92.94 score higher than the lowest value (dimension). The standard deviation is 24.75.

Besides, we consider, that the modeling of regression model can be useful in process of our analysis. The purpose of regression analysis is to analyze relationships among variables (in our analysis - cluster development and university ranking), where the results serve the following two purposes: a) answer the question of how much y changes with changes in each of the x's (x1, x2,...,xk), and b) Forecast or predict the value of y based on the values of the X's.

Table 1 Regression analysis results

Call:				
lm(formula = form, data = data)				
Residuals:				
Min	1Q	Median	3Q	Max
-22.3795	-5.3636	-0.2053	4.9153	26.6815
Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	36.75130	2.14150	17.161	< 2e-16 ***
University Ranking	0.34790	0.04341	8.014	1.32e-11 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
Residual standard error: 9.241 on 73 degrees of freedom				
Multiple R-squared: 0.468, Adjusted R-squared: 0.4608				
F-statistic: 64.23 on 1 and 73 DF, p-value: 1.324e-11				

Source: Authors' own elaboration

Statistic significance of the model:
H0: model is not statistically significant
H1: model is statistically significant
p-value: 1.324e-11 < 0.05 we reject null hypothesis and we approve alternative hypothesis that model is significant

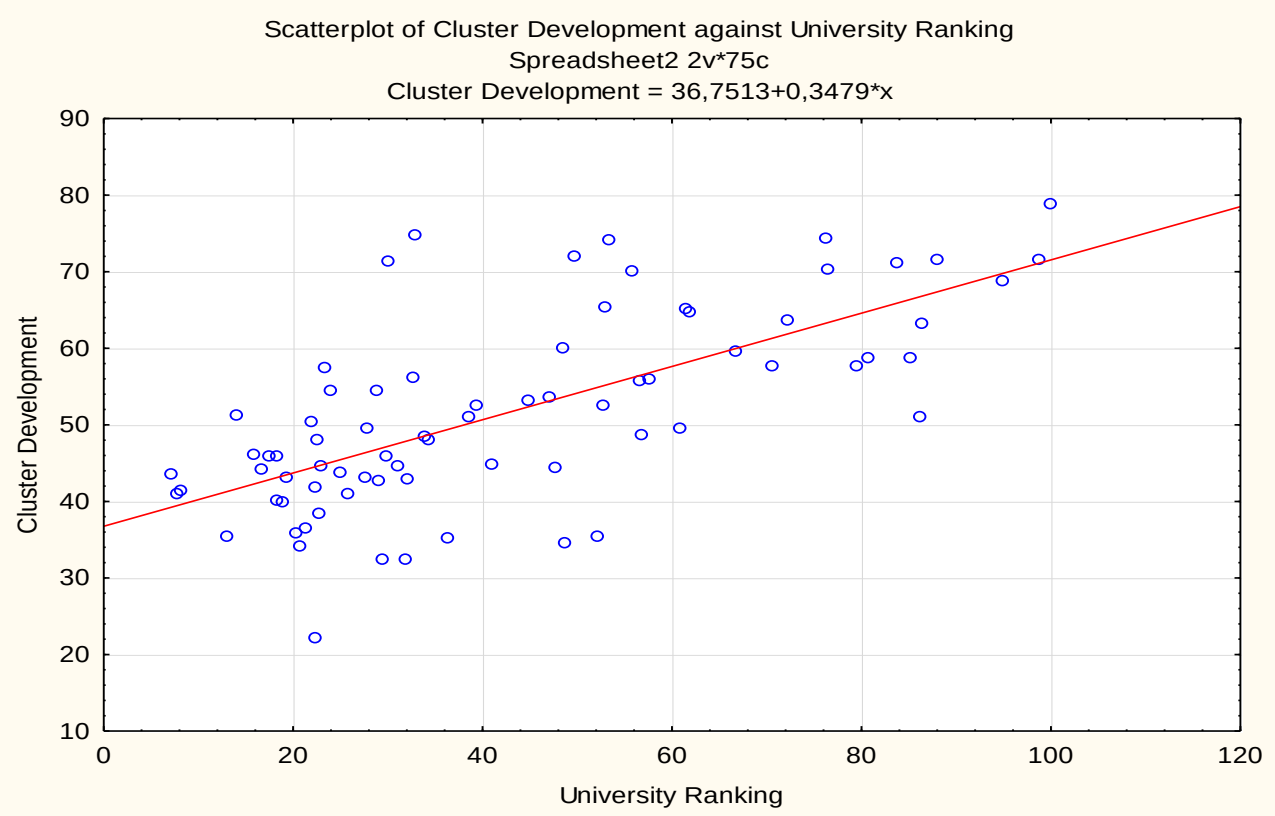

Figure 2 Linear regression model
Source: Authors' own elaboration

This model describes that 21.2 % of variability of dependent variable (Cluster development), which is due to the differences in our independent variable – University Ranking, while the rest 78.8% are other factors that were not taken into account in this case.

Statistic significance of the variable:
H0: variable is not statistically significant
H1: variable is statistically significant
p-values: 1.32e-11 < 0.05 (University Ranking) we reject null hypothesis for both variables and we approve alternative hypothesis that variable University Ranking is significant.

Interpretation the results:
Ceteris paribus: if University Ranking will increase by one score Cluster Development will increase by 0,34 score.

Thus we received the regression linear model (Figure 2):
Cluster development = 36.751 + 0.3479 * University Ranking.

The greatest positive deviation of the true value of the model is 26.6815 score, the largest negative - -22.3795 score. Almost half of the balances are in the range from the first quartile (1Q = -5.3636 score) to the third (3Q = 4.9153 score).

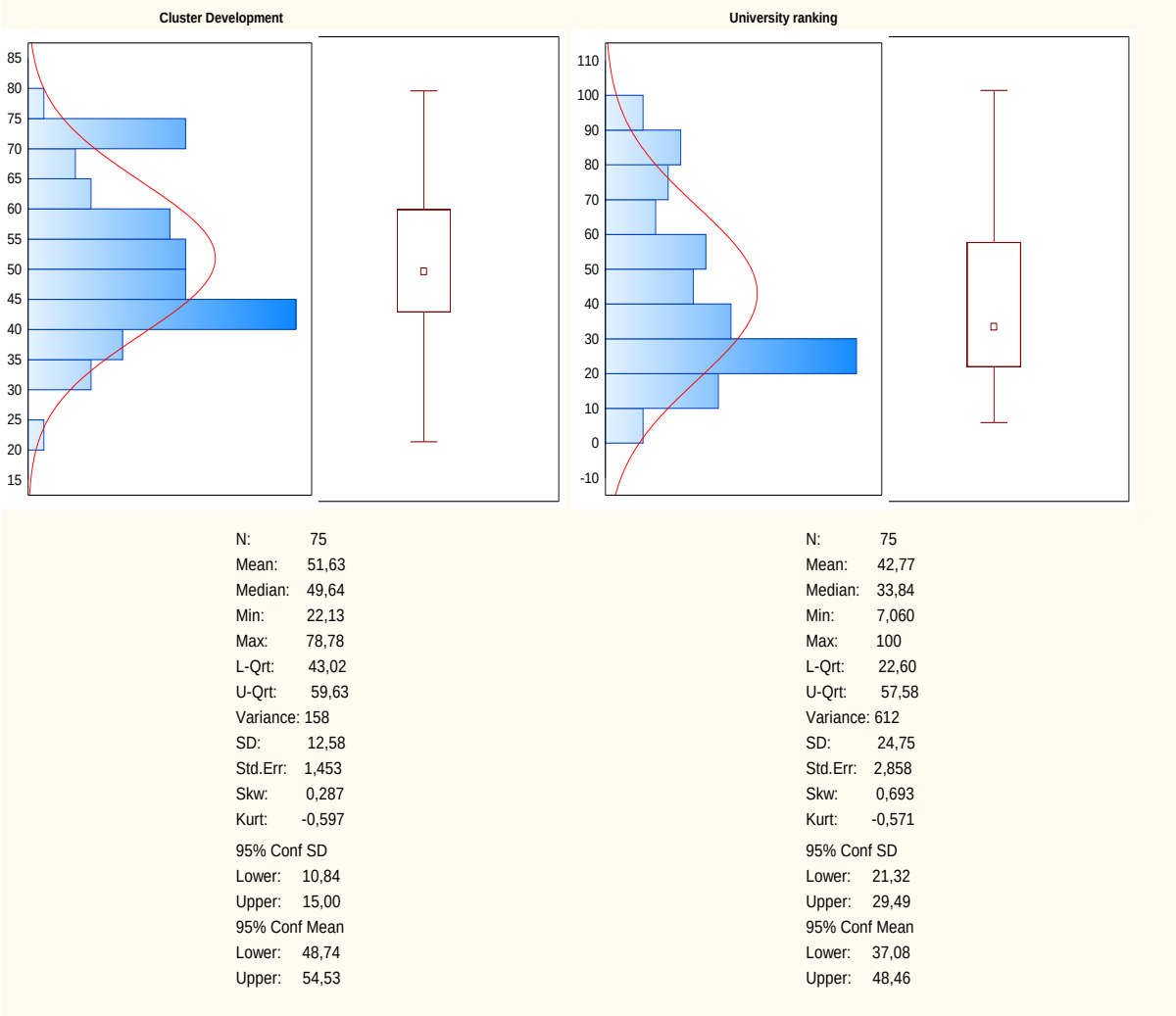

Figure 3 Descriptive statistics of such indicators as Cluster Development and University Ranking
Source: Authors' own elaboration

According to the Figure 3, we can see the numbest of countries with a University Ranking level in the range of 40-45 score, the lowest is 75-80, the mean University Ranking - 51.63, the median - 49.54. Accordingly, the level of cluster development: the numbest of countries are in the range of 20-30 scores, the lowest are in 0-10. On the one hand, the median of the indicator of cluster development is 49.64. This means that the level of cluster development in some countries does not exceed 49.64, while in others - exceed it. It is necessary to admit, that the median, equal to 49.64, is slightly less than the mean value of 51.63. On the other hand, the median of the indicator of university ranking is 33.84. This means that the level of university ranking in some countries does not exceed 33.84, while in others - exceed it. It is necessary to add, that the median, equal to 33.84, is significant less than the mean value of 42.77.

Thus, the obtained calculated results of our research indicate about influence the universities on the state of cluster development and could be used by stakeholders as an instrument for developing the clusters. First of all, by governments of countries as one of the element of mechanism of regulation of clusterization's process, because if the state will implement an effective policy for improving the competitiveness of higher education, in result - will increase Universities' Ranking,

that as a whole will lead to activation of cluster development (1 point of University Ranking to 0,34 point of Cluster Development). Therefore, we think, that our results can be used by the state in elaboration a mechanism for the development of clustering of the economy. Furthermore, the received results strengthen the role of universities and the necessity of realization an effective state policy in the field of education.

4 Conclusion

The challenges of the economical present of a globalized economy, which are oriented on knowledge create the need to strengthen the aspects of innovation development, development of innovation infrastructure, the functioning of which would be aimed on the activating the innovation processes, which will be ensuring the high rates of economic growth. In these conditions the significant role in the development of research and innovation infrastructure is played by the system of higher education and the universities, in particular. The aims of increasing the effectiveness of socio-economic and scientific and technical policy involve the using of clusterization in development, based on the links of scientific institutions and operating enterprises in the network structure for the production of goods, services and innovations. Thus, the correlation-regression analysis showed a notable relationship between cluster development and university ranking, which indicate on the impact of universities and the state of higher education on the cluster development of the country. Nowadays the process of clustering is an effective tool for ensuring the sustainable development of the country's regions. In general, both the cluster structers and the regional research and scientific structures with the participation of universities are focused on solving the problems which related to cooperation between science and production, increasing the efficiency of using the potential of the region and the country according to the triple helix.

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