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# Cluster analysis of higher-education competitiveness in selected European countries

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## ABSTRACT

The subject of research in this paper is higher-education competitiveness on account of its impact on the enhancement of social and economic competitiveness, as well as on the growth of human capital and creation of social knowledge. The purpose of this paper is to group the selected European countries according to higher-education competitiveness, by means of the hierarchical cluster analysis method, with a special focus on the position of Serbia. Higher-education competitiveness in the chosen countries is analysed by means of three indicators of competitiveness: the ratio of the number of students per number of inhabitants, the number of students per number of employed, as well as the amount of budgetary funds allocated per student. The research results indicate different higher-education competitiveness in the analysed countries and also the fact that, according to this analysis, Serbia is in the group of countries with low competitiveness of higher education.

## 1. Introduction

Within the European higher-education field, special attention is placed on the international competitiveness of the European system of higher education (The Bologna Declaration of 19 June 1999). This is motivated by the fact that the development of higher education is fundamental for the growth of social and economic development, and as such is given a prominent place in Europe and worldwide. Speaking of the influence of higher education on social development, one of the traditional roles of higher-education institutions is 'to teach students, to carry on research and to provide services to the community' (Mora & Vila, 2003, p. 122). On the other side, there are opinions that the basic role of higher education should be more utilitarian, such as to provide employment (Weber & Bergan, 2005).

In the area of economic development, higher education contributes to the increase of productivity and competitiveness, primarily through the growth of human capital. In other words, it helps create better-educated, qualified professionals. Competitiveness of higher education implies a better quality of higher education and its ability to attract students,

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as well as the possibility of providing employment to a greater number of graduates, thus contributing to establishing a knowledge-based society. Higher-education competitiveness and its role in the creation of a knowledge-based society are especially important for transitional countries, considering the dynamics of societal and economic changes, as well as the changes in their education systems.

The methodological indicators of higher-education competitiveness in the countries analysed in this paper are based on the ratio of the number of students per number of inhabitants, the number of students per number of employed, as well as the amount of budgetary funds allocated per student. The above indicators are applied for establishing higher-education competitiveness by the methodology for calculating the European index of competitiveness drafted by Robert Huggins (2005) and which is applied for establishing competitiveness in the countries and regions within the European Union, regions in Great Britain, as well as countries and regions in Europe (Huggins & Izushi, 2002; Huggins, 2005; Ćosić, Katić, Kiš, & Andjelić, 2009; Kabók, Kis, Csüllög, & Lendák, 2013).

The subject of research in the paper is analysis of higher-education competitiveness in EU countries, as well as in Serbia. Higher-education competitiveness is perceived through hierarchical cluster analysis, by grouping countries, based on three indicators: the number of students per 1000 inhabitants, the number of students per 100 employed, as well as the amount of budgetary funds allocated per student. The goal of this study is to produce quantified and scientifically based data on the ranking of the Republic of Serbia regarding the competitiveness of its higher education, in the 2006–2010 period. Serbia is compared with the 27 EU countries (Luxemburg was left out of the analysis due to lack of available data).

The results of this study are important for both academic and professional communities. They are of special interest to education authorities throughout the European education area, including Serbia, since they provide analysis of higher-education competitiveness in 28 European countries.

The paper contains five sections. Following the introduction is section 2, which presents a review of research relevant for the subject. The research methodology is described in section 3, while the results of research are presented in section 4. The concluding section proposes measures and activities designed for education authorities in EU and Serbia which are aimed at promoting higher-education competitiveness. This section also specifies the limitations present in this study, and proposes directions for further research in this area.

## 2.  Literature review

The question of increasing higher-education competitiveness (European Commission, EUROPE 2020, 2010; Gu, 2012; Huggins, 2005; Huggins & Izushi, 2002; Kabók et al., 2013) is one of the pivotal issues of socio-economic development in many countries. Berchem (2006) claims that the EU economy is becoming the most competitive and dynamic economy on the planet, due to the inherent international orientation of universities in EU countries. This author points out that higher education and research are key factors in social and cultural development, and are especially important for the economic competitiveness of every society.

Universities contribute to the development of competitiveness among countries by establishing scientific centres; thus universities and industry are becoming powerful partners in new development concepts leading towards higher competitiveness (Nursall, 2003; Zavrl,

2008). The curriculum in Hungarian universities is an example of this and it is based on the improvement of competitiveness of Hungarian higher education by establishing knowledge centres in different scientific fields at a great number of universities, which would cooperate closely with a number of different industries (Lentner, 2007).

Considering the problem of higher-education competitiveness within the context of an increased number of students, some authors (Egron-Polak, 2009) emphasise the crucial role of knowledge management and skills in the economic and social development of countries. This explains the increased demand for high-end research and the production of students with competences which provide advantages in the job market (Jongbloed & Vossensteyn, 2001). The references which pertain to the quality of research and education are an important prerequisite to defining the competitiveness of education institutions. Egron-Polak (2009, p. 43) points out that 'the number of students and universities around the world has grown dramatically over the past 2–3 decades'.

On the other hand, the Bucharest Message to the 2009 World Conference on Higher Education – Experiences and Recommendations from the Europe Region (UNESCO, 2009, p. 9) draws our attention to the fact that

> population decline and changes in age distribution are affecting higher education systems in most countries in the UNESCO Europe Region, with a consequence that higher education institutions see the need to compete for students both nationally and internationally, with the risk that international migration be required in order to overcome shortages of skilled labour.

In this context, new competencies for new demands of the labour market must be anticipated and increased opportunities for higher education and lifelong learning need to be created for improving and upgrading the skills of the workforce.

Modern trends in the development of higher education emphasise the increase in the number of students, i.e., the massification of higher education. Rather than addressing the issue of massification directly, Mora and Vila (2003), renowned authors in this area, include it in the discussion about higher education as an external factor which affects the way teaching, research, and related services are conducted. Massification of higher education is not solely restricted to the first massification wave, driven primarily by increased demand from the traditional student age groups (the absolute increase of admission rate), but is also driven by the second massification wave, which pertains to the change in the structure of the student population, in an attempt to include the non-traditional age groups (Lucas, 2001; Raftery & Hout, 1993). This second massification wave has still not reached the countries which are undergoing social and economic transition, such as Serbia. However, its presence was observed in the countries which have reached the level of universal higher education and are experiencing negative demographic trends.

A significant number of authors, especially during the last decade, have considered higher education from the aspect of economics and employment policy (Del Rey & Racionero, 2010; Schwarzenberger, 2008; Strehl, Reisinger, & Kalatschan, 2007), giving special attention to the aspect of the interrelationship between human capital increase and economic development. The studies discussed so far attempt to give a holistic view of higher education, not only relying on the economic perspective, but also emphasising the analysis of benefits for individuals which are the result of higher education. Thus, analyses (Eicher & Chevaillier, 2002) show that university graduates stand better chances of employment and are less exposed to the risk of long-term unemployment. However, the relevance of such

findings is questionable for transitional countries, which include Serbia, which are facing high unemployment rates.

As opposed to the research efforts discussed above, which are similar and general in their nature, this study analyses the competitiveness of the higher-education sector in selected European countries, with special emphasis on the Republic of Serbia.

## 3. Data and methodology applied in research

The research is based on data used as a starting point in terms of indicators of higher-education competitiveness stating the number of students per 1000 inhabitants, the number of students per 100 employed, as well as the amount of budgetary funds allocated per student in EUR in 27 EU countries and Serbia. The given indicators were calculated on the basis of available statistical data (Eurostat, 2011; Statistical Office of the Republic of Serbia, 2011) as follows:

- – indicator of the number of students per 1000 inhabitants: the number of students in each analysed country is divided by the number of inhabitants and the numeric value obtained is multiplied by 1000;
- – indicator of the number of students per 100 employed: the number of students in each analysed country is divided by the number of employed, and the numeric value obtained is multiplied by 100; and
- – indicator of budgetary funds per student: the amount of yearly funds in euros allocated for higher education, in each analysed country, divided by the number of students.

The research covers a five-year period, from 2006 to 2010, including a summary of calculated indicators, as described, in Table 1.

For analysis of the indicators of competitiveness, cluster analysis was applied in the research. Cluster analysis is a mathematical-statistical method applying the procedure of grouping a set of different objects into clusters (groups), thereby ensuring that the objects in the clusters are mutually as similar as possible, but also as different as possible from the objects in other clusters (Tsitsiashvili & Osipova, 2015). In view of the large number of existing cluster analysis methods, the paper applies the hierarchical cluster method, the so-called 'agglomeration method', which assumes that each object is treated in the first step as a separate cluster. In the following step, the two closest objects merge into the first cluster. In the third step, either an object is added to that cluster or two clusters are connected to the second cluster. In each following step some objects are either combined into new clusters, or the already existing clusters are interconnected. In hierarchical cluster methods, a cluster once formed cannot be separated subsequently, but can only be connected to other clusters (Tsitsiashvili & Osipova, 2015).

The cluster analysis conducted in the paper should show which countries have a similar situation in terms of higher-education competitiveness measured by the given indicators. Countries analysed in this classification study are generally described by two terms used in the following formula (Gordon, 1996):

(i) Dimension profile matrix $nxpX \equiv (x_{ij})$, where $x_{ij}$ designates the value of the $i,j$ matrix term ($I = 1, ..., n; j = 1, ..., p$);

**Table 1.** Summary of indicators of competitiveness in selected European countries in the 2006–2010 period.

| Serial No. | Name of country | 2006 Number of students per 1000 inhabitants | 2006 Number of students per 100 employed | 2006 Budgetary funds per student in euros | 2007 Number of students per 1000 inhabitants | 2007 Number of students per 100 employed | 2007 Budgetary funds per student in euros | 2008 Budgetary funds per student in euros | 2008 Number of students per 100 employed | 2008 Number of students per 1000 inhabitants | 2009 Number of students per 100 employed | 2009 Budgetary funds per student in euros | 2009 Number of students per 1000 inhabitants | 2010 Number of students per 100 employed | 2010 Budgetary funds per student in euros |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Serbia | 31.0 | 11.3 | 528.3 | 32.3 | 11.9 | 646.0 | 1143.5 | 11.9 | 32.2 | 87.5 | 1197.2 | 32.2 | 12.6 | 1201.9 |
| 2 | Croatia | 30.8 | 8.6 | 6000.0 | 31.5 | 8.7 | 6062.0 | 7182.8 | 8.8 | 31.4 | 91.3 | 2807.4 | 31.4 | 9.0 | 2805.4 |
| 3 | Belgium | 37.5 | 9.3 | 10969.9 | 37.2 | 9.0 | 11208.7 | 11766.2 | 9.0 | 39.2 | 90.4 | 11883.9 | 39.2 | 9.5 | 11931.4 |
| 4 | Bulgaria | 31.5 | 7.8 | 3862.1 | 33.7 | 8.0 | 3837.3 | 4763.3 | 7.9 | 36.1 | 91.6 | 4810.9 | 36.3 | 9.0 | 4830.2 |
| 5 | Czech R. | 32.9 | 7.0 | 7708.1 | 35.3 | 7.4 | 6825.1 | 6483.2 | 7.8 | 39.8 | 91.6 | 6548.0 | 39.7 | 8.5 | 6574.2 |
| 6 | Denmark | 42.2 | 8.2 | 12925.2 | 42.6 | 8.3 | 13689.3 | 13468.1 | 8.1 | 42.6 | 91.6 | 13602.8 | 42.4 | 8.6 | 13657.2 |
| 7 | Germany | 27.8 | 6.1 | 10862,8 | 27.7 | 6.0 | 11491.8 | 11928.1 | 5.8 | 29.7 | 93.7 | 12047.4 | 29.8 | 6.3 | 12095.6 |
| 8 | Estonia | 50.8 | 10.6 | 3341.3 | 51.2 | 10.5 | 4400.0 | 4450.7 | 10.4 | 50.9 | 88.6 | 4495.2 | 51.0 | 12.0 | 4513.2 |
| 9 | Ireland | 44.2 | 9.1 | 9200.0 | 44.1 | 9.0 | 10501.4 | 11000.0 | 8.5 | 41.0 | 90.5 | 11110.0 | 40.9 | 9.9 | 11154.4 |
| 10 | Greece | 58.7 | 14.7 | 5050.0 | 54.0 | 13.4 | 5050.0 | 5737.7 | 13.2 | 53.5 | 86.6 | 5795.0 | 56.4 | 14.5 | 5818.2 |
| 11 | Spain | 40.9 | 9.1 | 9327.1 | 40.0 | 8.7 | 10432.3 | 10362.5 | 8.8 | 39.3 | 90.5 | 10466.1 | 39.2 | 9.8 | 10508.0 |
| 12 | France | 34.8 | 8.6 | 9610.5 | 34.2 | 8.3 | 10618.8 | 11117.7 | 8.2 | 33.8 | 91.7 | 11228.9 | 33.6 | 8.5 | 11273.8 |
| 13 | Italy | 34.5 | 8.8 | 7023.1 | 34.4 | 8.8 | 7210.9 | 7326.2 | 8.6 | 33.5 | 91.3 | 7399.5 | 33.3 | 8.8 | 7429.1 |
| 14 | Cyprus | 26.9 | 5.8 | 9575.9 | 28.5 | 5.9 | 8922.5 | 10014.3 | 6.7 | 38.9 | 91.9 | 10114.4 | 38.6 | 8.1 | 10154.9 |
| 15 | Latvia | 57.2 | 12.1 | 3810.3 | 56.8 | 11.6 | 4543.9 | 4951.1 | 11.4 | 55.4 | 87.3 | 5000.6 | 55.8 | 13.3 | 5020.6 |
| 16 | Lithuania | 58.4 | 13.3 | 4015.0 | 59.0 | 13.0 | 4652.3 | 4823.2 | 13.5 | 62.9 | 85.1 | 4871.4 | 63.3 | 15.7 | 4890.9 |
| 17 | Hungary | 43.5 | 11.2 | 5032.6 | 42.9 | 11.0 | 5068.3 | 5100.0 | 10.7 | 39.7 | 89.5 | 5151.0 | 39.7 | 10.5 | 5171.6 |
| 18 | Malta | 41.0 | 78.0 | 8991.9 | 41.1 | 75.9 | 8689.0 | 9603.5 | 5.9 | 25.0 | 93.6 | 9699.5 | 25.1 | 6.3 | 9738.3 |
| 19 | Netherlands | 35.5 | 7.0 | 12684.8 | 36.1 | 7.0 | 13276.0 | 13512.1 | 7.0 | 37.5 | 92.8 | 13647.2 | 37.3 | 7.4 | 13701.8 |
| 20 | Austria | 30.7 | 6.4 | 12922.5 | 31.5 | 6.5 | 13133.4 | 12260.6 | 7.0 | 36.9 | 92.4 | 12383.2 | 36.8 | 7.5 | 12432.7 |
| 21 | Poland | 56.2 | 14.9 | 3605.0 | 56.3 | 14.1 | 3811.8 | 4656.9 | 13.7 | 56.4 | 86.5 | 4703.5 | 56.3 | 13.5 | 4722.3 |
| 22 | Portugal | 34.8 | 7.1 | 7208.2 | 34.6 | 7.1 | 7939.8 | 7307.1 | 7.3 | 35.1 | 92.6 | 7380.2 | 35.1 | 7.5 | 7409.7 |
| 23 | Romania | 38.6 | 9.0 | 2376.0 | 43.0 | 9.9 | 2376.0 | 2376.0 | 11.3 | 51.1 | 88.1 | 2399.8 | 51.2 | 11.9 | 2409.4 |
| 24 | Slovenia | 57.3 | 11.9 | 6508.9 | 57.7 | 11.8 | 5955.1 | 6441.0 | 11.6 | 56.3 | 88.3 | 6505.4 | 55.9 | 11.8 | 6531.4 |
| 25 | Slovakia | 36.7 | 8.6 | 5038.7 | 40.4 | 9.2 | 4768.8 | 5089.3 | 9.4 | 43.4 | 90.1 | 5140.2 | 43.3 | 10.1 | 5160.8 |
| 26 | Sweden | 46.7 | 9.5 | 14122.2 | 45.4 | 9.1 | 15265.2 | 15556.5 | 8.9 | 45.7 | 90.6 | 15712.1 | 45.2 | 9.3 | 15744.9 |
| 27 | United Kingdom | 38.7 | 8.1 | 13088.3 | 38.9 | 8.1 | 13015.5 | 12256.6 | 7.9 | 33.3 | 92.9 | 12379.2 | 38.9 | 8.3 | 12428.7 |
| 28 | Finland | 58.8 | 12.6 | 10717.8 | 58.6 | 12.4 | 11278.6 | 11965.4 | 12.2 | 55.7 | 87.9 | 12085.1 | 55.4 | 12.1 | 12133.4 |

Source: Eurostat, Statistical Office of the Republic of Serbia and authors' calculations.

(ii) Difference matrix $D \equiv (d_{ij})$ and matrix of similarity $S \equiv (s_{ij})$ are values $n \times n$, where $d_{ij}$ represents the difference between the $i$-th and $j$-th terms, where $i, j = 1, ..., n$. These two terms are essential in order to differentiate the difference and similarity obtained from the assessment of pairs of elements derived from the matrix. When observing the difference element, the difference matrix meets the following conditions:

$$d_{ij} \geq 0;$$

$$d_{ii} = 0;$$

$$d_{ij} = d_{ji} \text{ for } i, j = 1, ..., n$$

During the classification process, measures of difference between the observed pairs are expected. Based on their differences, they are grouped into different clusters. Calculation of differences between two objects per each variable $\delta_{ij}$ is based on the following formula:

$$\delta_{ij} - F(\sum_{k=1}^{p} w_k z_{ijk}) (w_k \geq 0 (k = 1, ..., p)),$$

where $z_{ijk}$ is the measure of difference between the $i$-th and $j$-th object for the $k$-th variable. It is apparent that F is a linear monotone function. The value of $w_k$ presents the assigned weights to each variable during the construction of the measure of difference; when $w_k = 0$ it indicates that the $k$-th variable is not included in the analysis, whereas for $w_k, zak = 1, ..., p$, where $\sum w_k = 1$.

The description of the obtained hierarchical classification is presented by an n-tree or dendrogram. These two terms are used equally in this field.

If the n-tree is with the set of objects, $\Omega = \{1, 2, 3, .., N\}$ is the set T is the subset of $\Omega$ which meets the conditions:

$$\Omega \in T$$

$$\phi \in T$$

$$\{i\} \in T \text{ for all } i \in \Omega$$

$$\text{if } A, B \in T \text{ then } A \cap B \in \{\phi, A, B\}$$

Condition 4 ensures that the subset is hierarchically settled. The dendrogram or n-tree is presented by a tree root from which spread branches to the left and right side which are not empty.

In terms of the dendrogram for all pairs of objects, $(i, j)$ applies with amount $h_{ij}$ as the largest one which includes the smallest subset of the $i$-th and $j$-th object. Value $h_{ij}$ indicates that the difference between the $i$-th and $j$-th object is within the hierarchical classification. The difference between the two observed objects is smaller in comparison to the difference of each of them compared to other elements from the set:

$$h_{ij} \leq \max \left( h_{ik}, h_{kj} \right) \text{ for all } i, j, k \in \Omega$$

## 4. Results

By application of the described methodology, and on the basis of the performed hierarchical cluster analysis, countries are grouped into the four clusters presented in Table 2 and Table 3.

The above classification into clusters can also be presented as the dendrogram shown in Figure 1.

Based on the cluster analysis results (Review Table 3), it is perceived that the first cluster includes the 10 most developed EU countries, Denmark, Sweden, Germany, Austria,

**Table 2.** Hierarchical cluster analysis of higher-education competitiveness in selected European countries in the 2006 to 2010 period.

| Cluster | Number of countries | Members |
|---|---|---|
| 1 | 10 | Denmark, Sweden, Germany, Austria, Ireland, Spain, Netherlands, United Kingdom, Belgium, France |
| 2 | 5 | Romania, Hungary, Slovakia, Serbia, Bulgaria |
| 3 | 5 | Cyprus, Croatia, Portugal, Czech Republic, Italy |
| 4 | 8 | Malta, Estonia, Greece, Slovenia, Poland, Latvia, Lithuania, Finland |

Source: authors' calculations.

```
Denmark  ---------------------------------------------------------
Sweden                                         I                        I
Germany                                        I                        I
Austria                                        I                        I
Ireland                                        I                        I
Spain                                          I                        I
Netherlands                                    I                        I
United Kingdom                                 I                        I
Belgium                                        I                        I
France                                         I                        I
Romania  --------------------------                                     I
Hungary            I                                                    I
Slovakia           I                                                    I
Serbia             I                                                    I
Bulgaria           I                                                    I
Cyprus ------------                                                     I
Croatia        I                                                       I
Portugal       I                                                       I
Czech R.       I                                                       I
Italy          I                                                       I
Malta  ----------------------------------------------------------
Estonia          I
Greece           I
Slovenia         I
Poland           I
Latvia           I
Lithuania        I
Finland  -------
```

**Figure 1.** Dendrogram: hierarchical cluster analysis of higher-education competitiveness in selected European countries in the period from 2006 to 2010. Source: authors' calculations.

Ireland, Spain, the Netherlands, the United Kingdom, Belgium and France, with the highest values of the analysed indicators of competitiveness. The higher-education systems in the above-mentioned highly developed countries are directed towards outcomes, and the quality and competitiveness values in higher-education institutions are based on measuring the higher-education system performance, particularly in terms of the level of exploited capacity (number of students), quality of research and lecturers. Flexible budgets and allocated funds in accordance with the performance are considered to bring greater institutional autonomy and possibilities for long-term planning in higher education. A different paradigm of competitive allocation and control of public funds earmarked for performance-based higher education required these funds to be allocated by new measures and standards. Therefore, the pivotal elements of the financial strategies of the above countries in the field of higher education became: flexibility of assigned budgetary items, institutional autonomy in terms of handling the funds, enhanced entrepreneurship and management (Nugaras & Ginevičius, 2015), as well as defining the goals and level of success in higher-education institutions compared to planned fiscal goals.

Countries from this cluster fear that this kind of system will result in hyperproduction of graduates or result in a lower quality of higher education. For the given reasons, most of the mentioned countries are setting up state institutions for assessment of higher-education quality and competitiveness. According to research work of such state agencies, the quality of studies did not drop, primarily because there is a system providing general external control over higher education, and also because students are evaluated by external examiners who are supposed to 'ensure fair and equal treatment of all students, supervise the quality standard in the state and advise institutions on the quality of programme, and also to submit annual reports on their impressions and criticism on account of the institutions' (Canton et al., 2001, p. 92). It should also be pointed out that the characteristic of the mentioned countries with developed higher education and high competitiveness thereof is implementation of the funding model based on outcomes with a significant degree of funding autonomy in higher-education institutions in terms of redistribution of allocated funds coming from the state budget. This fact indicates a favourable economic position of higher-education institutions in the said countries. Likewise, some countries in this cluster (such as Sweden), in addition to allocating public funds directly to higher-education institutions, also have a

**Table 3.** Assessment of competitiveness in selected European countries in the 2006–2010 period, based on the hierarchical cluster analysis.

| Cluster | Number of countries | Members | Assessment of competitiveness |
|---|---|---|---|
| 1 | 10 | Denmark, Sweden, Germany, Austria, Ireland, Spain, Netherlands, United Kingdom, Belgium, France | Countries with high competitiveness in higher education directed towards outcomes. |
| 2 | 5 | Romania, Hungary, Slovakia, Serbia, Bulgaria | Transitional countries with low competitiveness in higher education and attempts to be released from state control in higher education. |
| 3 | 5 | Cyprus, Croatia, Portugal, Czech Republic, Italy | Countries with acceptable higher-education competitiveness and commitment towards adequate functioning of higher education pursuant to the higher-education objectives. |
| 4 | 8 | Malta, Estonia, Greece, Slovenia, Poland, Latvia, Lithuania, Finland | Countries with significant higher-education competitiveness and attempts to turn higher education towards outcomes and performance measurement. |

Source: authors' calculations.

highly developed system of state credits, so that significant resources are directly allocated to students, not to institutions.

The second cluster consists of five countries: Romania, Hungary, Slovakia, Serbia and Bulgaria. On the basis of the similarity aspect in higher-education systems, Serbia is in the cluster with the countries within its region, with the neighbouring transitional countries such as Hungary, Romania and Bulgaria, but also with Slovakia, as a transitional East European country and EU member. Higher education in transitional countries, including Serbia, inspired by Humboldt's model of the university (Lolić, 2006), relies on the tradition of freedom in teaching and learning. The given behaviour can be explained by the need to release the university from state control dominated by political parties (Neave, 2003, p. 27). Universities have tried to sustain their autonomy by new legitimacy within the process of societal transition. Under such circumstances, it is very difficult to achieve success in externally initiated (imposed) reforms, including the intrusion of the public funding model in higher education. While the basic trend in other parts of Europe, as already mentioned, is heading towards the output models and integral contract funding of higher education, as well as towards performance models, there is no intention for the time being in the higher-education systems of transitional countries to move in that direction. The educational systems of those countries were drawn into the transitional period burdened by the tradition of institutional state control. Budget items funding is a common means of allocation in the higher-education systems of transitional countries, although the need for change was perceived in all countries and steps are being taken towards greater institutional autonomy. However, the speed and orientation in terms of reforming the mechanisms, as well as the public funding models, differ from country to country in the said cluster.

As already said, Serbia is, according to the cluster analysis, in the cluster with the group of transitional countries with similar higher-education systems. The provision of more powerful socio-economic development in Serbia is based on creating a society of knowledge, learning and innovations, implying the need for further development of higher education and greater competitiveness thereof. Larger budgetary funds earmarked for higher education per student, a greater number of students, as well as greater employment of graduates would also lead to enhanced higher-education competitiveness in Serbia (Kabok, 2014). This indicates the need to intensify, in the future, efforts and resources in the field of higher education, the objective being to ensure that knowledge will be a reliable resource of competitive advantage in Serbia, compared to most EU countries.

The next, third cluster includes, likewise, five EU countries: Cyprus, Croatia, Portugal, the Czech Republic and Italy. The higher-education systems in the aforesaid countries are based on the Bologna process (Bologna Declaration of 19 June 1999), and in the transitional countries of this cluster (Croatia, Czech Republic) intensive reforms were implemented in the field of higher education. The goal of the reforms is to enhance competitiveness through development of the higher-education binary system where university education is conducted at universities, and professional education in further post-secondary schools and vocational training schools for higher education. Educational programmes can be conducted also in private educational institutions. The number of higher-education private institutions and study programmes has been increasing, although mostly in the non-university sector, and for example the Law on Higher Education in Croatia envisages the possibility of budgetary funding of study programmes for private institutions. Higher-education funding in the mentioned countries is based on the programme budget and formula model with predominantly

input-output criteria in allocating the budgetary funds for higher-education institutions. It is particularly emphasised that Italy allocates a smaller amount of public funds per student than other developed industrial countries in the European Union and such a policy of higher-education funding from public sources in this EU country is based on the position of renowned authorities in this field. In that spirit, when discussing the sources of higher-education funding, Nicholas Bar points out that relying solely on the public income does not lead to prosperity, development and competitiveness in higher education. The author says that there are limitations concerning priorities in public expenditures, and therefore 'the amount of funding per student drops, and the number of students grows' (Barr, 2004, p. 4). Also, some public funding may be 'hidden', or not directly included in the higher-education budget, such as different forms of tax relief (as in the case of the Czech Republic), different forms of health care and transportation subventions, although in some countries this is an integral part of the higher-education state budget, frequently called 'student standard services', as well as other forms of material support directed towards households, usually to the students' parents (Schwarzenberger, 2008).

The last, fourth, cluster includes eight countries: Malta, Estonia, Greece, Slovenia, Poland, Latvia, Lithuania and Finland. The characteristic of higher-education systems in the countries from this cluster and their competitiveness is the trend of reorientation towards outcomes and measuring the performance in higher education, as well as funding which gives the 'higher education institutions the freedom in distributing the funds for teaching and/or research in the way that suits these institutions' (Jongbloed & Vossensteyn, 2001, p. 256). The above mode of funding, as already mentioned, is known as lump sum funding and it replaces the previous dominant mode of funding, 'budget items funding' (Jongbloed, 2003, p. 124). Budget items funding is based on requests (activity plans, budget proposals) filed by the budgetary authorities – generally governments. The distribution of the budget is generally based on the previous year's items, and separate items are then negotiated between the representatives of educational institutions and the fiscal authorities, or founders. It needs to be said that the lump-sum funding mechanism enables and provides greater funding autonomy, but also greater responsibility for higher-education institutions concerning the effectiveness and efficiency of spending the allocated funds, which is reflected in special performance indicators in higher education.

## 5. Conclusions

The research results indicate different higher-education competitiveness in the analysed European countries. Taking into account the importance of higher-education competitiveness for the overall socio-economic and cultural development of every society, this competitiveness should be implemented in future in such a way that all countries, regions and higher-education institutions which contribute to global social development based on knowledge in Europe should have benefits therefrom. Creation of a knowledge-based society requires a growing participation of the population with higher education, and therefore the issue of achieving, sustaining and enhancing the level of higher-education quality and competitiveness is one of the key issues for which the competent authorities in higher education, in all European countries, should seek answers. In compliance with the development orientation towards greater participation of the population in higher education,

higher-education competitiveness needs to be perceived particularly from the aspect of the employability of graduates.

Research results indicate that higher-education competitiveness in Serbia is not adequate for the needs and dynamics of higher-education system development in transitional countries such as Serbia. A more powerful socio-economic development means creating a society of knowledge, learning and innovation, which implies the need for further development of higher education in Serbia and increasing its competitiveness. The quoted facts indicate the need to intensify, in the future, efforts and resources in the field of higher education with the purpose of ensuring that knowledge will be a reliable resource of competitive advantage in Serbia, compared to the EU countries. Based on research results, the educational authorities in Serbian higher education are advised to include mobility in the higher-education system as an element of higher-education quality and competitiveness. Mobility is a factor which improves the employment of graduate students, in addition to ensuring the constant compliance of higher-education study programmes to labour-market requirements.

Issues and limitations with reference to this research are related to the indicators of higher-education competitiveness analysed in the paper. There are some limiting factors for increasing the number of students, which do not come only from the domain of the policy and strategy of higher-education development, such as for example demographic changes, the socio-economic position of the population, interest in studies as a function of the labour-market trends, etc. On the other hand, there is the issue of unemployment, or reduced employment, as well as reduced budgetary allocations for higher-education funding on account of the economic and debtor crisis and the impact thereof on the analysed indicators.

Taking into account the quoted facts, the trends of further research will be with reference to the perception of higher-education competitiveness in European countries by means of other methods of analysis. Future research work will apply those methods which can give adequate results in perceiving these important issues.

## Disclosure statement

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