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TRANSPARENCY OF UNIVERSITY RANKINGS IN THE EFFECTIVE MANAGEMENT OF UNIVERSITY

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Abstract. University rankings are extremely important not only for future student, but also for universities themselves. They have a large impact on the institutions of higher education. A lot of universities believe, that rankings help them to maintain and create a reputation. Ranking systems function as some kind of fashion arena, where universities make comparisons between themselves. Universities want to improve their position in published classifications, so very often they try to change their policy and strategy. They also try to influence the ranking indicators, for example by hiring Nobel Prize winners.

Therefore, there is an increasing need for reliable and transparent information about schools. However universities need not only statistical data, but also the tools, which will be useful in their comparisons and evaluations.

The article presents the possibility of using one of the methods of graphic presentation of multidimensional empirical data structure, so called RGM, proposed by M. Rybaczuk. Thanks to this method universities could easily compare one another. They also could identify the fields of their activities, in which they are able to be better. The proposed way of graphical presentation of the universities could be a useful addition to traditional rankings, which just show us a lists of schools from the best to the worst.

Keywords: university, ranking, higher education, strategy, management, classification.

JEL Classification: I23.

1. Introduction

According to van Vught and Westerheijden (Vught, Westerheijden 2010), international discussions on higher education have given rise to a new concept called "transparency", which relates to the need to provide information about universities' activities. It is "perceived as a set activities intended to provide proof of quality to higher education institutions' external stakeholders, then creating transparent entails providing the information which these stakeholders need in order to form judgments and make decisions."

(Vught, Westerheijden 2010). It is not easy to obtain reliable and transparent information about universities, mainly due to the complexity of the systems of higher education. It requires so-called transparency tools (Ziegele 2013). Nowadays there are many forms of evaluations and comparisons of higher education institutions such as ranking, classification, college guide, accreditation, typology, ratinig and benchmarking (Vught *et al.* 2005, 2008; Nazarko *et al.* 2009; Hazelkorn 2012; Nazarko, Kuźmicz 2013).

In author's opinion the most popular are university rankings. Rankings list, as defined European Commission, "items in a hierarchical order according to identified criteria. Rankings compare universities sing weighted indicators which are aggregated, and then hierarchically ordered." (European Commission 2010). The main aim of university rankings is to present the relevant comparative information about the position of particular school. According to J. Sadlak, Director of UNESCO-European Centre for Higher Education (UNESCO-CEPES), rankings inform various social groups about the condition of the universities, but also stimulate competition in higher education sector (Sadlak 2007). In bibliography there has been a few authors who said that rankings have considerable influence of the sector of higher education (Liu, Cheng 2005; Thakur 2007; Clarke 2007; Kehm, Stensaker 2009; Marginson, van der Wende 2009).

The outcomes of university rankings are often used in the management of universities. This was confirmed by international researches, which were carried out under the auspices of the Institute for Higher Education Policy (IHEP), the Institutional Management in Higher Education (IMHE) and the International Association of Universities (IAU). The impact of university rankings on the decision of their stakeholders was analysed (Hazelkorn 2007, 2008). It turned out that the behaviour of higher education institutions is determined by ranking systems. The top universities believe that rankings can help them to maintain and create their reputation. Almost half of the respondents used their position for advertising in various publications, press releases, presentations and university's website. It is also worth drawing attention to the fact that the majority of respondents admitted to taking strategic actions after publishing rankings' results. They tried to identify and eliminate the weaknesses of their institutions and even reorganize them. They also tried to influence the criteria of rankings, for example, by hiring Nobel Prize winners. In a few cases, respondents appointed the team to supervise changes, which had led to improving their position in the rankings. Moreover, over 76% of respondents admitted to monitor the activities of other universities in the country and 50% of them observed the universities around the world.

Therefore, there is an increasing need for reliable and transparent information about universities. Current university rankings are usually presented in the form of ranking list, so-called league table. The league tables, as presented by A. Usher and J. Medow, are "ranking systems that provide a single integrated score that allows an ordinal ranking of entire institutions" (Usher, Medow 2009). The main idea of the majority of university ranking systems is the creation of the aggregated indicator, also called synthetic

variable, which is the basis of hierarchical ordering of analyzed universities. But universities need not only linearly ordered data, which are included in most of published rankings, but also the tools, which will be useful in their comparisons and evaluations. In author's opinion, university rankings, which only show lists of schools from the best to the worst, should also present the results of their comparison in graphical form. For this purpose one of the methods of graphic presentation of multidimensional empirical data structure, so called RGM (Rybaczuk 2002), could be used. Thanks to this method universities could identify the fields of their activities, in which they are able to be better. Then, more efficient management of those institutions would be possible.

2. The RMG method / theoretical framework

The set of n universities $\Omega = \{O_1, O_2, \ldots, O_n\}$, characterized by l features $\mathbf{X} = \{X_1, X_2, \ldots, X_l\}$, is the point of the method of graphic presentation of multidimensional data. It can be presented in the matrix $\mathbf{X}$, where x_{ij} is the value of j-th feature for i-th object.

$$\mathbf{X} = \begin{bmatrix} x_{11} & x_{12} & \ldots & x_{1l} \\ x_{21} & x_{22} & \ldots & x_{2l} \\ \ldots & \ldots & \ldots & \ldots \\ x_{n1} & x_{n2} & \ldots & x_{nl} \end{bmatrix} = \left[x_{ij} \right], \tag{1}$$

where: n – number of universities, $i = 1, 2, \ldots, n$, l – number of features, $j = 1, 2, \ldots, l$.

Let S is a structure of data in the l-dimensional space of features defined as the relationship:

- university – university, that is, the similarity of objects is described by one of the measures of distance,
- feature – feature, characterized by a measure of interdependence of indicators,
- university – features, expressing the normalized values of j-th indicator for i-th university.

The aim of this method is to obtain a picture of S^* of the structure S in the area of a circle in such way that the images of features and objects are presented as points on the plane. The features are placed on a circle with a radius of value 1, and objects inside it, on the surface delimited by the circle. To such assumption concerning the distribution of images of objects and features, data from matrix $\mathbf{X}$ must be normalized. The values of each x_{ij} should be included within the interval [0,2]. An example of the procedure of normalization is:

$$z_{ij} = \frac{x_{ij} - \overline{x_j}}{\max\limits_i \left| x_{ij} - \overline{x_j} \right|} + 1, \tag{2}$$

where: $i = 1, 2, \ldots, n$; $j = 1, 2, \ldots, l$.

The matrix of data after normalization takes the following form:

$$\mathbf{Z} = \begin{bmatrix} z_{11} & z_{12} & \cdots & z_{1k} \\ z_{21} & z_{22} & \cdots & z_{2k} \\ \cdots & \cdots & \cdots & \cdots \\ z_{n1} & z_{n2} & \cdots & z_{nk} \end{bmatrix} = \left[z_{ij} \right]. \tag{3}$$

In such case, the problem of mapping of multidimensional data in a circle on the plane comes down to finding the set of points (x_i, y_i), $i = 1, 2, ..., n$, which are the coordinates of images of the i-th objects and $(\hat{x}_j, \hat{y}_j)$, $j = 1, 2, ..., l$, which represents the coordinates of the images of the j-th features. It can be solved by finding the minimum of the following function:

$$F(D) = \sum_{i=1}^{n} \sum_{j=1}^{k} (z_{ij} - d_{ij})^2 \rightarrow \min, \tag{4}$$

where: d_{ij} – distance between the image of the j-th feature and the i-th object, expressed by the formula:

$$d_{ij} = \sqrt{(\hat{x}_j - x_i)^2 + (\hat{y}_j - y_i)^2} \tag{5}$$

with following limitations:

$$x_i^2 + y_i^2 \leq 1, \tag{6}$$

where: $i = 1, 2, \ldots, n$,

$$\hat{x}_j^2 + \hat{y}_j^2 = 1, \tag{7}$$

where: $j = 1, 2, \ldots, l$.

Figure 1 shows the essence of graphic presentation of four objects: U1, U2, U3 and U4 characterized by two features: X1 and X2 in the area of a circle on a plane.

The RMG method allows mapping points of placing features and universities in such way that minimize the divergence between the values of features describing universities and object-feature distances on the plane. As a result, the observation of the full data structure (university-feature, university-university and feature-feature relations) is possible. Thanks to this the comparative analysis of universities can be carried out, however:

- the closer the points representing images of universities are located, the more similar universities are;
- the closer the points representing images of features are located, the stronger positive correlation between them is;
- the more clearly images of features are located on the opposite side in relation to the centre of the circle, the stronger the negative correlation between them is;
- the larger distance of the point representing the image of the object from the image's features, the higher level of features for a given object is, and vice versa.

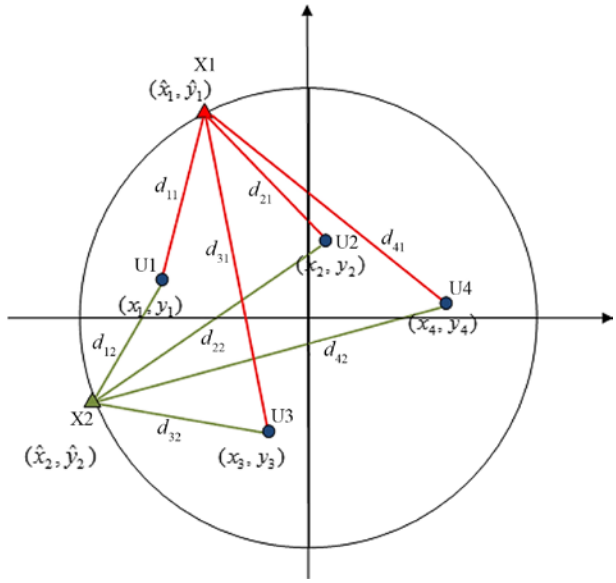

Fig. 1. Graphical presentation of the data structure using the RMG method (source: own study based on Rybaczuk 2002; Rybaczuk, Nazarko 2007)

3. Example comparison of three top polish universities

In the research study, the data from Perspektywy University Ranking 2012 (Perspektywy webside) was used. This ranking presented the list of 88 polish universities. Academic Higher Education Institutions (Academic HEIs) were characterised by 33 indicators, which were divided into 6 dimensions, such as Prestige, Academic Potential, Academic Effectiveness, Innovation, Learning Environment and Internationalization. Table 1 shows the list of indicators, which were used to prepare Perspektywy University Ranking. In order to avoid writing full name of particular criteria the abbreviations were introduced.

Due to the large number of criteria, the set of data was verified. To eliminate the indicators, which are strongly correlated, parametric Hellwig method (Hellwig 1981) was used. Implementation of this task will contribute to better transparency of the results of the comparative analysis. The final set of data includes 21 indicators. It is shown in the Table 1 (the indicators are in bold).

Firstly, the classic form of ranking, which presents a hierarchical ordering of universities from "the best" to "the worse", was analysed. Such example list of universities is shown in Table 2. The author doesn't present the whole list of schools, because it is available on the Perspektywy' website. In Table 2, there are only those, which opened Perspektywy' classification in 2012. The selected criteria and their values of ten top universities are also presented.

Table 1. The criteria of Perspektywy University Ranking 2012
(source: Perspektywy' webside 2012)

Group of criteria	Sign	Criteria
Prestige	P1	Employer reputation
	P2	Academic reputation (teaching)
	P3	International recognition
	P4	**Talented students application**
Innovation	**I1**	**Patents and licenses**
	I2	EU funding
	I3	**Infrastructure for innovation**
Academic Potential	**PN1**	**Parametric evaluation**
	PN2	**Right to confer PhD with habilitacja degree**
	PN3	**Rights to award PhD degrees**
	PN4	**Staff with highest qualifications**
	PN5	Accreditations
Academic Effectiveness	**EN1**	**Faculty development**
	EN2	**Academic titles awarded**
	EN3	**External funding for research**
	EN4	**Publications**
	EN5	Citations
	EN6	h-index
	EN7	EU programmes
	EN8	**PhD students**
Learning Environment	**WS1**	**Students – teaching staff**
	WS2	**E-holdings**
	WS3	**Printed library holdings**
	WS4	**Library facilities**
	WS5	Support for students' scientific interests
	WS6	**Sports achievements**
Internationalization	Um1	Programs in foreign languages
	Um2	Students studying in foreign language
	Um3	Student exchange (outbound)
	Um4	**Student exchange (inbound)**
	Um5	**International students**
	Um6	**Foreign teaching staff**
	Um7	**Multicultural composition of student body**

Note: the final set of data, which were used in the research, are in bold.

Table 2. Ten top Polish universities from Perspektywy University Ranking 2012 (source: Perspektywy' webside 2012)

Ranking	University	Selected criteria					
		P1	P2	P3	P4	I1	I2
1	Jagiellonian University	90.53	100	96.89	47.82	8.35	71.94
2	University of Warsaw	98.88	92.5	100	87.64	3.02	100
3	Adam Mickiewicz University	77.17	58.3	15.74	19.61	11.8	71.29
4	Warsaw University of Technology	100	42.05	32.15	34.85	43.45	76.41
5	Wrocław University of Technology	97.7	33.15	8.64	24.1	100	49.23
6	AGH University of Science and Technology	98.49	31.33	11.28	63.22	73.81	59.23
7	University of Wrocław	69.28	36.32	8.46	16.22	2.3	21.44
8	Lodz University of Technology	74.87	14.43	0.87	5.75	53.38	79.92
9	Nicolaus Copernicus University	64.28	21.01	4.97	13.76	10.79	45.94
10	Poznan University of Medical Sciences	39.61	17.72	2.15	53.37	2.01	14.52

The data about Polish universities presented in Table 2 were normalized according to following normalization formula:

$$z_{ij} = x_{ij} / \max_{i}\{x_{ij}\}, \tag{8}$$

where: x_{ij} – the value of the j-th features for i-th university.

According to the author, basing only on information from Table 2, it is not easy to compare selected universities. It is very difficult to identify our university's weaknesses, mainly due to the size of matrix of data (in such case: 88 universities x 33 indicators). But it would be possible to do thanks to graphical comparison on the plane.

In order to present the results of the RMG method, three top Polish universities – Jagiellonian University (U1), University of Warsaw (U2) and Adam Mickiewicz University (U3) – were compared.

Figure 2 shows the result of graphical presentation of the multidimensional data related to the selected higher education institutions. The positions of points in the circle, that illustrate universities, depend on the levels of criteria.

Basing on the graphical presentation of the universities structure (Fig. 2), universities can easily compare the levels of their indicators. They can indicate their strengths as well as weaknesses. When we try to interpret the distance university-feature, we should remember, that the bigger it is, the higher level of realization of the feature assigned to this unit becomes.

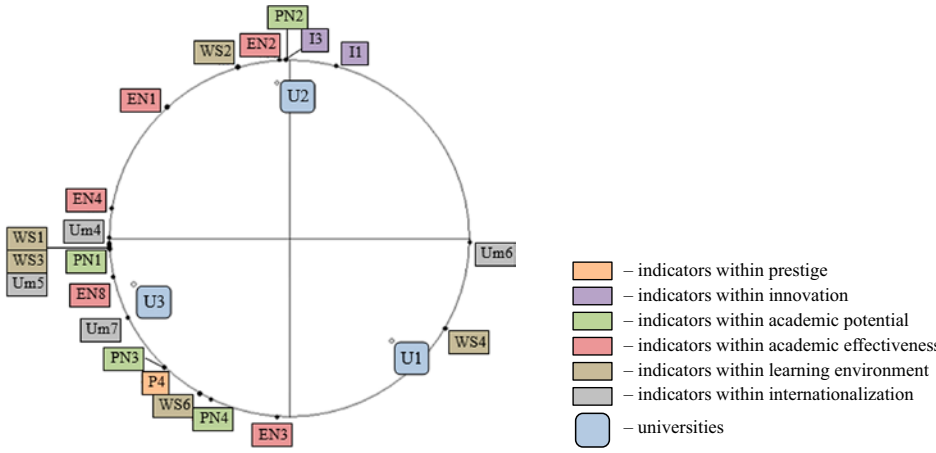

Fig. 2. Graphical presentation of the multidimensional data related to the selected HEIs (source: own study using the Visualization program)

The position of the point U1 mostly shows, that Jagiellonian University is characterized by a high level of academic effectiveness, which is determined by such indicators as: faculty development (EN1), academic titles awarded (EN2), publications (EN4) and PhD students (EN8). But from the external funding for research (EN3) point of view, this institution, in comparison to others (U2 and U3), occupies the last place in this classification. Furthermore, both Jagiellonian and Adam Mickiewicz Universities, as opposed to University of Warsaw, are characterized by a high level of innovation. The level of innovation is expressed as a number of patents and licenses (I1) and outstanding innovative facilities (I3). Moreover, University of Warsaw is the best in such fields as: external funding for research (EN3), staff with highest qualifications (PN4), sports achievements (WS6) and talented students application (P4).

Another example presents graphical presentation of the multidimensional data related to three top Polish technical universities. Warsaw University of Technology (U4), Wrocław University of Technology (U5) and Lodz University of Technology (U8) – were compared (Fig. 3). Moreover, in order to personalize the comparison, the indicators were selected by one of the student. The student showed interest in the indicators, which belong mostly to two groups of criteria: within learning environment and internationalization. The following criteria are: e-holdings (WS2), support for students' scientific interests (WS5), sports achievements (WS6), programs in foreign languages (Um1), student exchange (outbound) (Um3), EU funding (I2) and infrastructure for innovation (P3).

Basing on graphical presentation presented on Figure 3, identification of diffrences between the universities is relatively easy. Warsaw University of Technology, as opposed to others, distinguishes itself by high level of such indicators as: sports achievements

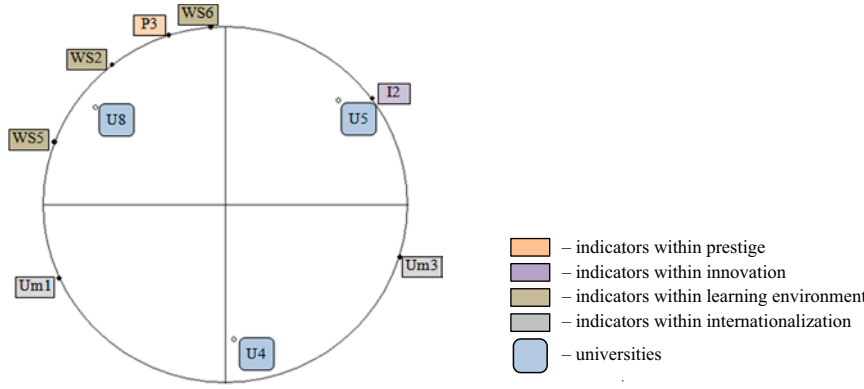

Fig. 3. Graphical presentation of the multidimensional data related to three selected technical univesities (source: own study using the Visualization program)

(WS6), international recognition (P3) and e-holdings (WS2). A huge number of programs in foreign languages (Um1) is a strength of Wrocław University of Technology. Therefore, Lodz University of Technology is the best in student exchange (outbound) (Um3).

Basing on presented comparisions, universities would be able to identify their strengths and weaknesses and then they could take action to improve their position in the ranking. The results of such evaaluations could also be useful in the management of universities.

This way of evaluation of schools could be very useful not only for institutions of higher educations, but also for young people and their families. They could compare selected universities. Furthermore they could choose indicators which they are the most interested in.

4. Conclusions

University rankings became a subject of many scientific discussions connected mainly with methods of selection of data and weights, the presentation of classification's results, as well as the reliability of data (Proulx 2007; Raan 2007; Tofallis 2012; Dill, Soo 2005; Rocki 2005; Saisana, D'Hombres 2008; Wende 2008; Harwey 2008). The results of this article may be a significant voice in the ongoing debate.

University rankings are an important source of comparative information for various stakeholders. Year by year, they have an increasing impact on the higher education institutions and their environment, influencing, for example, the decisions of the future students in their choice of schools, the government policy of financing higher education institutions as well as the way of managing the universities. Therefore, it is critical for the ranking organizations to provide the public with the possibly most objective picture of the position of particular universities in relation to one another (Jarocka 2012).

The quality of evaluation of institutions of higher education depends on the reliability of information, but also on way of their processing and presentation. The large number of details criteria, which can be use in university rankings, does not necessarily contribute to greater transparency of the higher education system. Therefore, the selection and aggregation of the data and presentation of the results of comparative analysis are very important problems in every ranking's methodology. Moreover, according to the author, the tool for comparative analysis should be able to generate information, which is relevant from the point of view of different users. The final set of criteria should depend on their individual priorities and preferences.

In author's opinion, the ranking organizations should supplement the classic form of ranking, namely a hierarchical ordering of universities from "the best" to "the worse" by such tools, via which their stakeholders could make their own, individual comparisons.

The proposed procedure of the graphical presentation of the multidimensional data allows to compare selected universities. It also makes it possible to decide which criteria of evaluation are the most important and interesting as well as which universities will be compared. It gives them possibility to find and compare similar schools in terms of specific purposes. Basing on the results of the RMG method universities will be able to know their weaknesses in comparison with others and then they could decide about ways of effective management.

From author's point of view, proposed way of graphical presentation of the universities could be a useful addition to traditional rankings. It would contribute to the transparency of universities' evaluations and encourage to create individual comparisons. Furthermore, the RMG method is ready to use in creating reliable and transparent rankings, not only in education sector.

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