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HOW TO MEASURE AND COMPARE THE VALUE OF ORGANIZATIONS. THE CASE STUDY OF HEIS*

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Abstract. In an age of general and permanent evaluation of everyone and everything, the issue of finding measures and methods of measuring value has come to the fore. Evaluation (or measurement of value) has been a subject of a number of publications; a lot of methods (better or worse) of measuring the value of organisations and workstations have been devised. The purpose of the paper is to attempt to use radar charts to support the measurement and comparison of the value of universities as an example of organisations. The research question is the following: How can radar charts be used to measure and compare the value of organisations? The hypothesis formulated assumes that radar charts can be used in various areas of analysing the value of organisations, including: to measure the value of organisations (dynamic); to make multi-criteria comparisons of organisations; to evaluate organisations from the point of view of various groups of stakeholders. The comparative research was done at 11 public universities located in 6 Eastern European countries (Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia) and two other public universities, one in Great Britain and the other in the United States, which were a type of benchmarks. The criteria constituting the value of universities that were adopted for the research were measurable (objective) factors taken into account in university rankings: Faculty/ Student Ratio, International Faculty Ratio, International Student Ratio, Citation, Industry income, Patents awarded (size-normalised), Regional joint publications, Presence and Impact. The research done with the use of radar charts let the author carry out the measurement of the value and a comparative analysis of selected universities, and draw conclusions.

Keywords: value; radar chart; universities; comparative analysis; stakeholders

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JEL Classifications: M10, I21, I23

1. Introduction

In days when everything and everyone (products, companies, employees, and science) is subject to evaluation, the issue of defining the value, differentiating the value and measuring the value is becoming more and more important. As long as the assessment of the value of products or material resources is easy to make, the evaluation

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(measurement) of the value of an organisation and employees may cause some difficulties. How can the value be measured? From the viewpoint of various groups of stakeholders value can take various forms. It is different for the company owner (owners), investors, shareholders and cooperators, and different for clients, workers and prospective workers.

Since there are so many points of view in the case of an enterprise and approaches to the issue of the assessment of the value, the evaluation of the value of such organisations as universities seems to be even more problematic. What measures should be used to evaluate the value of a university? The same as in the case of companies, the value is assessed by various stakeholders: employees, students, university authorities, government, society, and students' families. How to measure the value of what the university gives? The question is not about the material value, which is quite easy to evaluate (the value of land, buildings, equipment), but about the value that the university gives: the value of educational service, the value of scientific research, the value of patents, and the value of graduates on the labour market. How to measure the value? The evaluation is made even more difficult in this case due to the fact that the value of university's products changes over time. What factors and measures should be used to at least come closer to the assessment of the value of each university from the viewpoint of various groups of respective stakeholders?

In this paper attempts were made to measure the value of selected universities with the use of radar charts and mathematical formulas. What was done was a comparison of various factors that are important when assessing universities in international rankings, such as: QS, THE, U-Multirank and Webometrics.

Factors taken into account in the comparative analysis of the value of universities were as follows: Faculty/Student Ratio, International Faculty Ratio, International Student Ratio, Citation, Industry income, Patents awarded (size-normalised), Regional joint publications, Presence, and Impact (online visibility).

Making an assumption that it is more justified to choose organisations from countries at a similar stage of development and more importantly of similar possibilities of development, the author focuses on universities from Eastern Europe in the paper. To present the global situation of the public universities subject to the review, they have also been compared to public universities in the USA and the EU that could be treated as a kind of benchmarks. The reference to the benchmarks was not intended to illustrate what the Eastern European universities should do to unquestionably, absolutely and at any cost come close to those models, but to find solutions that can be reasonably adapted in the specific domestic conditions, and constantly learn and improve.

In the author's opinion the universities from the USA and UK that are the best in the rankings should not be seen as an ideal but as a kind of benchmarks on the way to own perfectness, the perfectness that would be adjusted to the specific conditions and possibilities in which the universities from Eastern European countries operate. Paraphrasing the words by Dwight D. Eisenhower deemed to be a dogma in the management sciences that "the plan is nothing, planning is everything", it can be said that "perfectness is nothing, improvement is everything".

2. University value concept from the point of view of various groups of stakeholders

A lot has been written about value. Value can be defined in a number of ways, depending on the perspective. As Rev. Stanisław Kowalczyk said "The concept of value is used in mathematics, economics, ethics, aesthetics, sociology, religion and philosophy" (Kowalczyk 1986: 38). The theories of value presenting philosophers' viewpoints say: value depends on the subjective states of human beings and other sentient creatures. It means that certain things and states are valued as long as they are a source of pleasure, are desirable or preferred (the subjective theories of value). Value can be categorised according to the states of individual sentient creatures, but at the same time good depends on what is desirable or valued by people. It means that for example knowledge, achievements and recognition are good regardless of the pleasure and satisfaction they bring. The objective

theories of value say that some things and states can be valuable regardless of their influence on the states of mind (New World Encyclopedia 2016).

Evaluation that always assumes certain criteria and hierarchy of values is an important component of every single field of knowledge; it may lead to making right or utilitarian assessments and from the philosophical point of view it is defined as “making assessments, or formulating assessing judgements that present an approval or disapproval of a given status quo, phenomenon, occurrence or behaviour (conduct) from a certain point of view and in a certain scope” (Encyklopedia PWN 2019).

What an economics finds to be a value is a feature of things that is assessable in monetary terms and seen as more or less desirable or useful. The assessment of value is done in reference to goods and economic phenomena (Bartkowiak 2008; 24). An ethicist will think of ethical and moral values (Osborne 1934/2016), a manager of, for instance, the value of human capital (Smith, Parr 2005; Berzkalne, Zelgalve 2014; Wiederhold 2014), and teaching and learning specialists of educational value (Conrad, Serlin 2006; Schierenbeck 2012; Waks 2016). Value can be examined in quantitative terms (e.g. price, the speed of service) or in qualitative terms (e.g. design, customer experience).

Hence, considering such a large number of concepts, perspectives and definitions, what should one see as a value of a university? Can it be assumed together with V.A. Zeithaml that there are four ways of understanding value also in respect of universities: “value is low price”, “value is the thing that is expected from the product”, “value is the quality that I receive for the price I pay” and “value is the thing that I receive in exchange of what I give” (Zeithaml 1988)?

Looking at value from a different viewpoint, a value of a university is “an opportunity of prolonging own mission, own activity in different spheres of human life. A graduate who will proudly talk about own university, proudly transferring that recollection to family, social and professional spheres is priceless for the university. Therefore, the value of a university is not measured by people, doctorates and computers, but by immeasurable attributes: certain people’s respect, trust and devotion, which are among the oldest of its values” (Krasuska-Korzeniec 2003). Such a way of understanding the value makes the feature very difficult to measure, if its measurement is possible at all (Broadbent 2010; Girdzijauskaite et al. 2019).

The value of a university can be measured by using the following lenses: financial impact, place-based impact assessment and the total value approach (Naylor 2016: 27-28). The financial impact can be assessed with the use of a number of quantifying methods and methods measuring various streams of spendings (personnel costs, etc.) and also their indirect and induced influence. Universities attract a lot of students hence what can additionally be measured is what their money is spent on in the local economy: accommodation, restaurants and shops. A combination of the two methods of financial influence is most frequently applied. The place-based impact assessment is the assessment of how a university influences the city/town and the area it is located in. There are a lot of positive consequences of having a university in the vicinity, such as an improved image of the city/town, increased movement and an intensified feeling of revival. Moreover, there are also advantages deriving from the rental of real estate, more shops and their higher turnover, more jobs, less crime and higher safety. Such results are interesting for local financial institutions, but the method is the least frequently used of all because the indicators are less clear and more complex, and require long-term research. On the other hand, the total value approach comprises methods which attempt to incorporate a financial value into things that lack a clear financial value, such as well-being, learning, and cultural enrichment. Clearly, it is attempted to define for instance social and educational advantages in quantity terms. Both the cost-advantage approach (Näslund et al. 2006; Raval, Gronroos 1996) and the total value approach try to show that the final monetary value is an exchange between the costs incurred and the advantages gained. These can be the unused values, such as the university passive-use value (e.g. people simply value the fact of having a university in their neighbourhood; even if they do not study at

it, they do appreciate the fact that others have such a possibility or that they (or their children, grandchildren) will have such an option in the future (Naylor 2016: 27-29).

The value of university education can also be viewed in various categories: longer lifespan, freedom, social mobility (Schlissel et al. 2018) or honesty, care and inclusion (The Value Proposition's Double Meaning 2019) or added value (Coates 2008).

When discussing the issue of the value of universities from the viewpoint of various groups of stakeholders one needs to say that the circle of stakeholders that are in direct or indirect relation with higher education institutions (Minkiewicz 2003: 9; Benneworth, Jongbloed 2010; Marshall 2018) is much wider than in the case of other organisations (Fazlagić 2012: 187) due to the number of private and social elements connected with teaching, including teaching at a higher education level (Wilkin 2009: 88).

The issue of the value of a university from the point of view of stakeholders was described by Mark Allen (Allen 2019), and Agnieszka Piotrowska-Piątek identified the stakeholders of higher education institutions. What is especially interesting is the research done by Piotrowska-Piątek, because it made it possible to distinguish 22 categories of external stakeholders of universities. The most frequently mentioned categories were: employers, representatives of the economy, local government authorities and labour market institutions (Piotrowska-Piątek 2016: 89). Additionally, each category of stakeholders was placed on the so-called map of stakeholders which shows that respondents (vice-chancellors of higher education institutions) were included the following into the strategic group of stakeholders: the Polish Accreditation Committee (PKA), the Minister of Science and Higher Education (MNiSzW) and students (Piotrowska-Piątek 2016: 90-91).

As for the internal stakeholders, there are not so many discrepancies owing to the fact that the majority of authors mention three main groups: management, staff and trade unions.

Higher education institutions are a special type of organisations the product of which is not a material article but a service comprising multi-directional teaching of students studying at it. What is also specific is the students' requirements towards the universities that act as service providers. Among the requirements there can be "...physical changes (receiving a diploma), changes influencing the state of mind (acquiring knowledge), changes influencing the mental state (becoming more self-confident) ..." (Lipska, Bojanowska 2009: 132). Moreover, the requirements or expectations of other stakeholders, such as employers, parents, society, the government, etc., are also specific. Therefore, the measurement of the value of a university needs to take into account various perspectives and take advantage of a number of measures. The measures constituting the value for various groups of organisation stakeholders have been described by M. Leśniewski (Leśniewski 2011: 113).

This paper focuses on the measures of setting university value that are measurable. The selection of the topic derives from the fact that the evaluation of universities can be very difficult and subjective from the viewpoint of various groups of stakeholders.

3. Objective measures of setting value

M. Kwiek said that "the world of academic science (national and international alike) became fully measurable during the last decade, and the achievements of prestigious scientific production became highly visible. (...) The age of indicators and quantification in creating a scientific policy has come. What has also come is measuring scholarly productivity (by publications) and scholarly impact (by citations). All in all, what we are observing now is governance by indicators, in other words the management of the system of science (and at the same time scientists) by indicators" (Kwiek 2018).

The aforementioned opinion is not among those that agree with such the measurable approach to scholars and universities' achievements; nonetheless, it cannot be said that the quota approach lacks sense. From the point of view of strategic management, the quantification makes the task easier and lets scholars more objectively analyse, process and use the data obtained. As Ł. Sułkowski notes in relation to the existing paradigms of strategies, "the strategy of an organisation is not usually an implementation of a plan based on hard data, but more a social game of the organisation success accomplished in conditions of complexity and uncertainty. However, it is important to avoid the said "oversocialised" image of an organisational strategy. Questioning the complete rationality in strategic management should not mean that an assumption of a complete irrationality is accepted" (Sułkowski 2008: 39-41).

Therefore, the selected criteria assessed in international rankings of universities published every year have been deemed to be the measurable/objective (Austen, Kotas 2016) factors this paper focuses on.

Just like it is possible to be sceptic and hostile (Hazelkorn 2007) towards the rankings and detailed factors and the manners of their assessment (Dill, Soo 2005; Griffith, Rask 2007; Salmi, Saroyan 2007; Hazelkorn 2008; Van Vught 2009), the use of measurable data published in the rankings seems to be logical, especially considering the fact that the rankings unquestionably have made crucial contribution by focusing on transparency (Marginson 2009; Van Vught, Ziegele 2012). Assuming that some data is reliable and measurable enough to make the benchmarking of universities possible, a set of factors that can be attained from those rankings has been used further in the study of the value of public higher education institutions. The descriptions of obtaining and processing those data are found in the methodologies of each of the rankings.

The precursor of world rankings of universities that classifies scientific and research achievements attained by universities is said to be the Academic Ranking of World Universities (ARWU), which has been publishing its findings since 2003. The methodology of the ranking promotes universities that stand out thanks to their scientific perfectness measured by, for instance, the number of Nobel Prizes granted, which is to the disadvantage of the humanist and technical disciplines. It also lacks factors that would assess the quality of teaching or the conditions of studying (ARWU 2018).

Owing to the lack of data for 2019 that has been accepted as the basis of the research done, the criteria assessed in that ranking have not been taken into account in the analysis of the value of universities.

The Quaquarelli Symmonds World University Ranking (QS), which was published from 2004 to 2009 in cooperation with The Times and later as an independent ranking, assessed 1,000 universities from all over the world in 2019. The top 50 comprised: 19 universities from the USA, 8 from the UK, 5 from Australia, 3 from Canada, 3 from China, 3 from Hong Kong, 2 from Singapore, 2 from Japan, 2 from South Korea, 2 from Switzerland and 1 from France. The same as in the case of ARWU, in the QS ranking the universities from Eastern Europe are placed far behind, with the best places taken by Charles University in Prague (317 position) and University of Warsaw - 394 positions; the worst rates were given to universities from Bulgaria and Romania (places from 801 to 1000). The objective criteria of the QS ranking that have been selected in the measurement of the value of universities are as follows: Faculty/Student Ratio - F/SR, International Faculty Ratio - IFR, International Student Ratio - ISR (QS 2019).

As the authors of the next ranking, which started to be published in 2004, assure, "Webometrics is a ranking of all universities in the world, not only a few hundred of institutions from the developed countries" (Webometrics 2019). There were about 12,000 universities from all over the world assessed in the Webometrics ranking (January 2019), including: 54 universities from Bulgaria, 80 universities from the Czech Republic, 68 universities from Hungary, 416 universities from Poland, 103 universities from Romania, 36 universities from Slovakia, 279 universities from the UK and 3,270 universities from the USA (important for further analyses). Two factors from

the ranking have been deemed to be criteria constituting the value of universities and have been used in further analyses, i.a. Presence and Impact (Webometrics 2019).

The next ranking is the Times Higher Education World University Ranking (THE), which started publishing own findings in 2010, and in 2019 it assessed 1,258 universities all over the world. The top 50 in the ranking comprises the following: 24 universities from the USA, 7 from the UK, 3 from Canada, 3 from Germany, 2 from Switzerland, 2 from China, 2 from Australia, 2 from Hong Kong, 1 from Belgium, 1 from Japan, 1 from Singapore, 1 from France and 1 from Sweden. In the Times ranking there was 1 university from Bulgaria, 14 universities from the Czech Republic, 7 universities from Hungary, 12 universities from Poland, 7 universities from Romania, and 98 universities from the UK and 172 from the USA. It should be stressed that the universities from the Eastern European countries subject to the analysis were ranked very low. Taking into account the universities under analysis, the best score was attained by the Charles University in Prague, which took place 401-500, and the worst by the Sofia University - 1000+. The criteria selected from that ranking to measure university value were as follows: Citation and Industry Income (THE 2019).

The authors of the report titled *Assessment of Higher Education Learning Outcome* found the U-Multirank ranking to be the ranking that is currently the most significant attempt to overcome the limitations of the majority of university rankings. U-Multirank is a project “aiming at increasing the importance, scope, diversity and transparency of information about higher education” (Tremblay et al. 2012: 39). The first edition of U-Multirank was in 2014. It presented information about over 850 universities from more than 70 countries. In 2019 it was possible to compare over 1700 universities from 96 countries all over the world. Since 2018 the authors of the ranking also publish such lists as “TOP 25 Performers” in which various criteria that can be important from the point of view of different people/organisations interested in the university results are taken into account. U-Multirank does not show such combinations as “the best universities in the world/continent/country”, providing recipients with the option of selecting factors according to which the interested make their own rankings and comparisons. Two criteria found to be important for an analysis of the university value are Patents awarded (size-normalised) and Regional joint publications. From the point of view of the universities from Eastern Europe subject to the analysis, it should be said that only the Jagiellonian University, Poland, was ranked in “TOP 25 Performers” in one of the analysed categories, namely “Regional joint publications” under the “Regional Engagement” university activity dimension (U-Multirank 2019).

4. Radar charts - practical application, merits and limitations

A radar chart was first used by Georg von Mayr, a German statistician, in his work *Die Gesetzmäßigkeit im Gesellschaftsleben*, published in Oldenbourg in 1877 (Mayr 1877: 78-79). At present the use of radar (web) charts is gaining interest in various areas of management theory and practice, including organisation strategic management. The areas in which radar charts are successfully applied are: sustainable development management, university management, product management, and human resource management. Radar charts (web charts) are especially used to:

- present various criteria of sustainable development of cities, and this way make it possible to compare the sustainability levels in those cities (European Commission 2018: 13-15),
- compare profiles, strengths and weaknesses of countries and other facilities,
- present and compare the level of factors depicting universities all over the world (U-Multirank),
- present and compare products of competing companies (chocolate, cars),
- inspect the improvement of quality in order to illustrate the performance indicators of each programme in place,
- graphically evaluate the organisation in comparison with its competition or in comparison to itself (a dynamic benchmark) (Perło 2014: 84; Multan, Wójcik-Augustyniak 2016: 93-94),
- illustrate multidimensional data with descriptive statistics (Friendly 1991),

- present, compare and evaluate professional competence/ characteristics/ requirements of staff working in organisations (Filipowicz 2004: 108; Bombiak 2014: 182),
- determine the strengths and weaknesses of sports players.

A radar chart is a specific layout of axes in which several axes, the number of which is equal to the number of characteristics/ statistics/ criteria/ factors (n), start from the same point. The angles between the axes are the same and equal $360^\circ/n$ each. A radar chart is a two-dimensional chart representing three or more quantitative variables. The angle and relative position of the axes is typically uninformative (*Radar Chart* 2019).

Yet, this current uninformative nature of the angle between the axes of a radar chart can be changed into a very important data from the point of view of the measurement of the organisation value.

Radar charts require metrics, which means that all variables subject to the analysis should be expressed in numbers, but the values may differ on each axis. In the case of a description and inference on the basis of radar charts, it can be assumed that the values along the central circle represent the minimal values acceptable for each of the variables, and the external circle represents the standardized, target or ideal values of the relevant variables/ products/ cities/ organisations/ people.

Despite such a wide array of applications, radar charts are also criticised because “in the case of the majority of data the charts are not effective, since it is not possible to easily compare the data when the frames form criss-cross” (Czapiewski 2010). This radial nature places a particular emphasis on the high values along the external ring on the chart. If there are any zero values, the chart may be very difficult to interpret (Odds 2011). A radar chart is not suitable for organising data either. The critics of radar charts claim that they are “nothing else but a line chart with the category scale in the form of a circle” (Czapiewski 2010).

Various areas in which radar charts can be applied mainly focus on a graphic presentation of certain phenomena subject to analysis. However, have they already been used to compare the value of an organisation? The author suggests applying radar charts to measure and compare the value of organisations by the case of universities. For the purpose of this paper it has been also assumed that the measurement of the value of higher education institutions can be made on the basis of various factors (criteria).

5. Methodology

This paper attempts to use radar charts as a tool supporting the measurement and comparison of the value of organizations, such as higher education institutions. The research question is the following: How can radar charts be used to measure and compare the value of organisations? The hypothesis formulated assumes that radar charts can be used in various areas of analysing the value of organisations, including:

- to measure the value of organisations (dynamic);
- to make multi-criteria comparisons of organisations;
- to evaluate organisations from the point of view of various groups of stakeholders.

In this case the charts serve as an illustration of the methodology of actions taken to measure the value of an organisation.

In the paper 11 universities from 6 Eastern European countries and 1 public university from the UK and 1 public university from the USA, which served as benchmarks, were subject to a comparative analysis. According to the World Population Review (2019), there are 9 countries constituting Eastern Europe, these are: Ukraine, Poland, Romania, the Czech Republic, Hungary, Belarus, Bulgaria, Slovakia and Moldova, and according to the statistical classification Eastern Europe comprises the Russian Federation apart from the countries listed above

(United Nations 2019). For the purpose of this study, only universities located in countries that are members of the European Union have been taken into account. Therefore, the research refers to universities in Poland, Romania, the Czech Republic, Hungary, Bulgaria and Slovakia.

Only public universities were selected for the benchmarking and those institutions that were found in all rankings taken into account in the paper, namely QS, The Times, U-Multirank, and Webometrics. The criteria adopted to compare the universities were only those from the relevant rankings that were measurable (objective) indicators, not experts' assessments/opinions, namely: Faculty/ Student Ratio, International Faculty Ratio, International Student Ratio, Citation (research influence), Industry income, Patents awarded (size-normalised), Regional joint publications, Presence (number of webpages), and Impact (number of external networks).

The analysis of the value of universities can be thematic - teaching, science, knowledge transfer, etc., or general - the value of universities as such. Given the fact that universities from not all countries of Eastern Europe could be found in the relevant rankings in thematic sections, only a general comparison of the universities was made, without any division into scientific fields or disciplines.

The research done with the use of radar charts and formulas for calculating the surface area of irregular polygons let the author carry out the measurement of the value and a comparative analysis of selected universities, and draw conclusions on that basis.

Table 1. Numerical ranges and corresponding levels of the studied factors (criteria)

Level	Ranges for:				
	Faculty/ Student Ratio (F/SR)	International Faculty Ratio (IFR), International Student Ratio (ISR)	Citation, Industry Income, Patents awarded (size-normalised), Regional Joint Publications	Presence	Impact
1	20.1-25.0	0-12.0	0-20	3201-4000	2401-3000
2	15.0-20.0	12.1-24.0	21-40	2401-3200	1801-2400
3	10.1-15.0	24.1-36.0	41-60	1601-2400	1201-1800
4	5.1-10.0	36.1-48.0	61-80	801-1600	601-1200
5	0-5.0	48.1-60.0	81-100	0-800	0-600

Source: own elaboration

Table 1 presents numerical ranges and the corresponding levels of the studied factors (criteria) that have been taken into account in the measurement and comparison of the value of organisations (universities). Allocating individual values to respective ranges (e.g. on a five-point scale from 1 to 5) let the author make the values of the factors (criteria) uniform on the radar chart axes. The necessity of the normalisation resulted from the fact that each factor (criterion) was calculated with different variables, for instance F/SR according to formula "Numbers of students in total/Numbers of employees in total"; IFR according to formula "Numbers of foreign employees/Numbers of employees in total" and ISR according to formula "Numbers of foreign students/Numbers of students in total". Citation, Industry Income, Patents awarded (size-normalised), and Regional Joint Publications are expressed in percentage values quoted in the rankings, factor Presence is measured as size (number of webpages) of the main webdomain of the institution. It includes all the subdomains sharing the same (central or main) webdomain and all the file types including rich files like pdf documents. Factor Impact shows the Number of external networks (subnets) originating backlinks to the institution's webpages. After the normalization, the average value between the two sources is selected (QS, THE, U-Multirank, Webometrics 2019).

Taking into account the ranges is especially significant for the purpose of unifying the values of such factors (criteria) as Faculty/ Student Ratio, Presence and Impact owing to the fact that in their case lower values are ranked higher than higher values.

Table 2 shows example values of analysed factors (criteria) according to the division into the minimal level, the real level of the relevant organisation, and the maximal level, important as far as the comparison of values of various organisations is concerned, and for inference about gaps in the levels of factors (criteria) in relation to the optimal, target and planned values.

Table 2. Example values of relevant factors (criteria) according to the division into the minimal level, real level of a given organisation and maximal level

Detailed list	F/SR	IFR	ISR	Citation	Industry Income	Patents awarded (size-normalised)	Regional Joint Publications	Presence	Impact
Minimal factor (criterion) level	1	1	1	1	1	1	1	1	1
University X	3	2	4	2	2	2	2	5	5
Maximal factor (criterion) level	5	5	5	5	5	5	5	5	5

Source: own elaboration

A radar chart consisting in a few variables (factors/criteria) makes it possible to continue with the next stages of the measurement of value thanks to a graphic presentation of the number of sides and angles between sides resulting in the formation of an irregular polygon that is the basis for calculating the value of an organisation (Fig. 1).

In order to calculate the value of organisations, the formula for calculating the surface area of irregular polygons, which in this case is rather the formula for calculating the surface area of irregular triangles, the number of which depends on the number of sides/angles of the polygon, was used. The formula has been presented below (Matematyka 2019):

$$P_{\text{area}} = \frac{1}{2} \times \sin \alpha \times (axb + bxc + cxd + dxe + exa),$$

assuming that the polygon is a pentagon. Depending on the number of angles, there will be a hexa-, hepta-, octa-, nona-, or n-gons, and thus the number of sides that will be taken in the calculations will respectively change. Nonetheless the rule is the same.

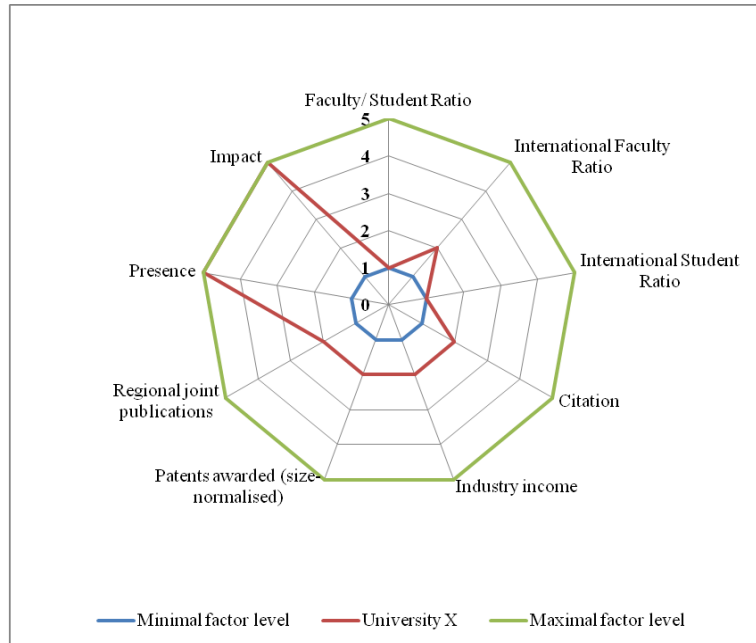


Fig. 1. Radar chart taking into account the values of relevant factors (criteria) according to the division into the minimal level, real level of a given organisation and maximal level

Source: own elaboration

However, it should be said here that to measure the value of organisations with the formula for the surface area of irregular polygons taking into account fewer than 5 and more than 12 factors (criteria) is not recommended. For the purpose of further calculations it has been assumed that the maximal length of the sides (a, b, c, d, ...) is 5.

With the assumption that the maximal length of the sides is 5 and the number of angles (variables/criteria) 9, the maximal surface area (value) will be:

$$\begin{aligned}
 a &= b = c = d = e = f = g = h = i = 5 \\
 \alpha &= 360^\circ/9 = 40^\circ \\
 \sin 40^\circ &= 0,6427876 \\
 P &= \frac{1}{2} \times \sin \alpha \times (axb + bxc + cxd + dx e + exf + fxg + gxh + hxi + ixa) \\
 P &= \frac{1}{2} \times 0,6427876 \times (5 \times 5 + 5 \times 5 + 5 \times 5 + 5 \times 5 + 5 \times 5 + 5 \times 5 + 5 \times 5 + 5 \times 5 + 5 \times 5) = 72,315
 \end{aligned}$$

The data found in Table 3 present values of selected measurable factors (criteria) obtained from four 2019 ratings (QS, THE, U-Multirank, Webometrics) for 13 universities taken into account in the analyses. They are the basis of the next stages of the process of measuring university value. The stage that follows is the allocation of each value of the factors (criteria) to appropriate ranges on a five point scale from 1 to 5. As a result of that procedure the data presented in Table 4 has been obtained.

Table 4 contains also the sums of individual factors and their values according to the formula for the surface area of an irregular polygon. The data presented shows that the highest value calculated on the basis of the analysed factors (criteria) was attained in 2019 by a public university from the UK, namely the Imperial College London, and amounted to 51.745. Despite being the highest, the value constituted about 72% of the maximal value. On the other hand, the lowest value, 5.785, was attained by a university from Romania - the West University of

Timișoara. The result made up less than 8% of the maximal value. Considering the universities from the Eastern European countries, the highest value amounting to 23.462 (about 32% of the maximal value) was attained by 2 universities from Hungary and the Jagiellonian University from Poland.

Table 3. Values of selected measurable factors (criteria) from four 2019 rankings for analysed universities

University	Country	F/SR	IFR	ISR	Citation	Industry income	Patents awarded (size-normalised)	Regional joint publications	Presence	Impact
Sofia University	Bulgaria	11.61	0.48	5.47	12.6	35.2	0	51.6	67	1380
Charles University in Prague	Czech Republic	10.58	8.83	17.22	55.9	34.4	0.25	39	143	238
Masaryk University	Czech Republic	16.38	10.36	23.28	34.6	35.1	0.32	26.5	83	395
Eotvos Lorand University	Hungary	16.15	1.89	9.08	44.5	35.5	0	60.5	31	596
University of Szeged	Hungary	8.92	7.52	19.45	41.2	37.3	0.65	22	577	720
Alexandru Ioan Cuza University	Romania	21.9	3.16	6.13	12.9	34	0	42.5	1669	1419
West University of Timișoara	Romania	18.68	0.27	4.48	20.1	34.3	0	23.8	3399	2919
Comenius University in Bratislava	Slovakia	11.31	0	9.62	22.8	36.4	0	30.6	358	1175
Slovak University of Technology in Bratislava	Slovakia	10.14	1.35	2.94	9.9	36.5	0	31.7	361	1548
University of Warsaw	Poland	11.27	4.79	7.76	44.7	34.2	0.25	37.3	440	353
Jagiellonian University	Poland	9.34	2.49	6.59	50.7	34.8	0.5	28.6	349	506
Imperial College London	UK	4.32	54.08	55.93	97.8	67.3	6.74	25.8	658	134
University of California, Berkeley	USA	14.44	49.44	16.83	99.7	49.3	67.32	23.8	109	4

Source: own elaboration

Table 4. Level of selected measurable factors (criteria), their sum and value for the analysed universities in 2019

University	Country	F/SR	IFR	ISR	Citation	Industry income	Patents awarded (size-normalised)	Regional joint publications	Presence	Impact	Total	Value
Sofia University	Bulgaria	3	1	1	1	2	1	3	5	3	20	16.391
Charles University in Prague	Czech Republic	3	1	2	3	2	1	2	5	5	24	22.819
Masaryk University	Czech Republic	2	1	2	2	2	1	2	5	5	22	19.605
Eotvos Lorand University	Hungary	2	1	1	3	2	1	4	5	5	24	23.462
University of Szeged	Hungary	5	1	2	3	2	1	2	5	4	25	23.462
Alexandru Ioan Cuza	Romania	1	1	1	1	2	1	3	3	3	16	9.963

University												
West University of Timișoara	Romania	2	1	1	2	2	1	2	1	1	13	5.785
Comenius University in Bratislava	Slovakia	3	1	1	2	2	1	2	5	4	21	17.998
Slovak University of Technology in Bratislava	Slovakia	3	1	1	1	2	1	2	5	3	19	14.463
University of Warsaw	Poland	3	1	1	3	2	1	2	5	5	23	21.534
Jagiellonian University	Poland	4	1	1	3	2	1	2	5	5	24	23.462
Imperial College London	UK	5	5	5	5	4	1	2	5	5	37	51.745
University of California, Berkeley	USA	3	5	2	5	3	4	2	5	5	34	38.568
Maximal value		5	5	5	5	5	5	5	5	5	45	72.315

Source: own elaboration

6. Applying radar charts to measure and benchmark the value of universities

As already mentioned, it is assumed in the paper that radar charts can be used in various areas of the analysis of the value of organisations, including:

- to measure the value of organisations, also in the dynamic perspective;
- to make multi-criteria comparisons of organisations;
- to evaluate organisations from the point of view of various groups of stakeholders.

6.1. Applying radar charts to measure the value of organisations, including the dynamic perspective

Radar charts can be applied to measure the value of a single organisation according to an array of factors (criteria). Hence, the 2019 value of the Jagiellonian University, as a case of a public higher education institution, amounting to 23.462, calculated according to the presented formula for the surface of an irregular polygon, can be illustrated in the manner seen in Fig. 2.

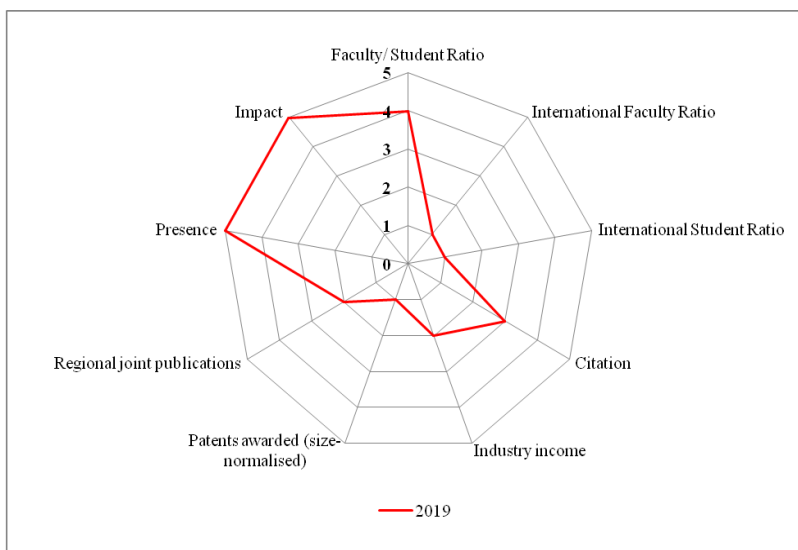


Fig. 2. Value of the Jagiellonian University in 2019

Source: own elaboration

Considering the dynamic comparison, the value of the Jagiellonian University changed over time (2016 and 2019) in the way depicted in Table 5 and in Fig. 3.

Table 5. Value of the selected university in 2016 and 2019

Jagiellonian University	F/SR	IFR	ISR	Citation	Industry income	Patents awarded (size-normalised)	Regional joint publications	Presence	Impact	Value
2016	1	1	1	2	2	1	2	5	5	16.713
2019	4	1	1	3	2	1	2	5	5	23.462

Source: own elaboration

The data presented in Table 5 show that the value of the Jagiellonian University significantly increased over the 4 years. Only two factors influenced that fact: Faculty/Student Ratio, which went up from level 1 to level 4, and Citation, which went up from level 2 to level 3.

However, it should be pointed out that the falling number of students per employee (F/SR) was not necessarily intended by the university authorities but it was rather a consequence of a decreasing number of the total number of candidate students and students in Poland (Statistics Poland 2019)

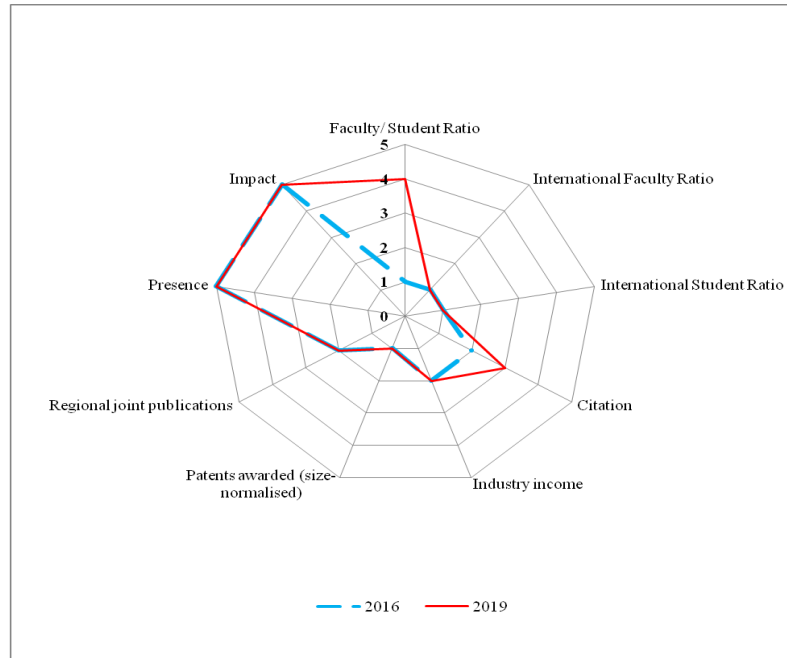


Fig. 3. Dynamic comparison of the value of the Jagiellonian University in 2016 and 2019

Source: own elaboration

6.2. Applying radar charts to multi-criteria comparisons of organisations (universities)

Radar charts make it possible to compare the value of all analysed public universities (Fig. 4). Nonetheless, the presentation of the results of the comparisons in a single figure is not a good move. As the illustration shows, a large number of organisations (universities) subject to the comparison leads to an unclear image and it cannot be the basis for drawing appropriate conclusions, which has already been indicated by critics of those charts.

Such a way of presenting the value of organisations only lets us identify the factors (criteria) that are at the same level in the case of each of the universities.

Hence in the majority of the relevant universities the following factors constituting university value are at a comparable (or the same) level: International Faculty Ratio, Industry Income, Patents Awarded (size-normalised) and Presence. On the other hand, strong differences are visible in the case of such factors as: Faculty/Student Ratio, International Student Ratio, Citation, Regional Joint Publications and Impact.

Such a comparison permits managers/university authorities to make decisions about the areas to which they should devote their efforts in the future.

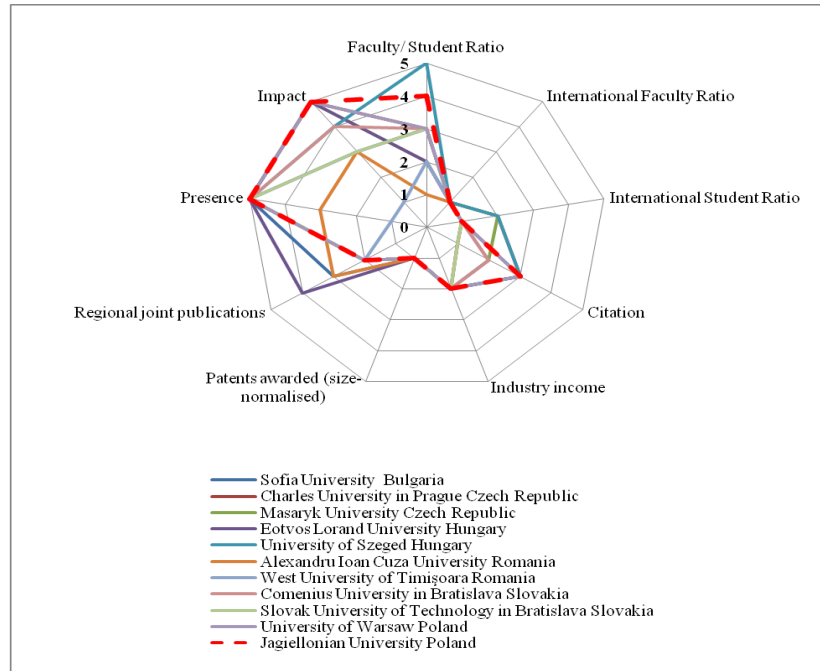


Fig. 4. Comparing the value of analysed universities in terms of the level of the selected measurable factors (criteria)

Source: own elaboration

Radar charts may also serve to compare the value of organisations (universities) from the same country (Fig. 5). To illustrate that functionality, two best Polish public universities have been chosen, namely the University of Warsaw and the Jagiellonian University.

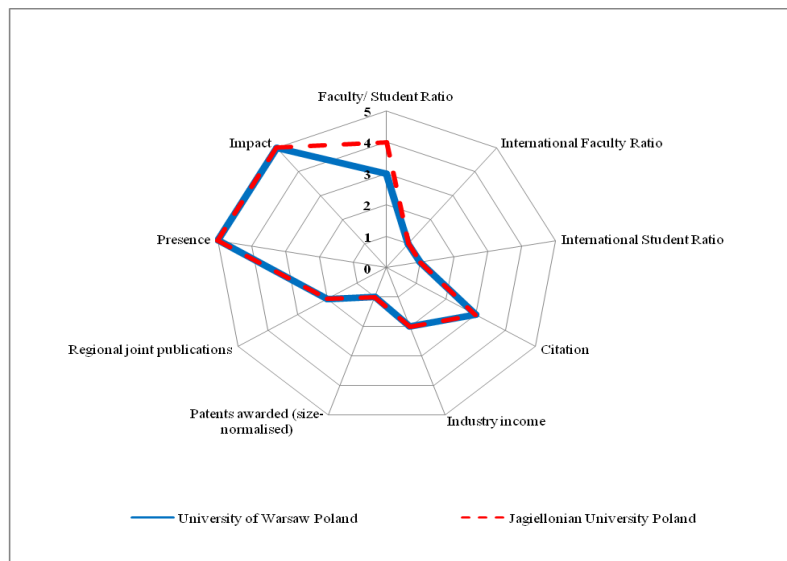


Fig. 5. Comparing the value of selected universities from the same country

Source: own elaboration

The data shown in Fig. 5 indicates that in 2019 the value of the Jagiellonian University was higher than the value of the University of Warsaw. The reason for that was a higher level of Faculty/Student Ratio in the case of the Jagiellonian University than the University of Warsaw. What the University of Warsaw should do to improve the rate is either increase the number of university staff members or reduce the number of students taken.

Radar charts can be also applicable to comparing the value of universities with those that are treated as benchmarks. In this case a Polish public university (the Jagiellonian University) has been compared with public universities from the USA (the University of California, Berkeley) and the UK (the Imperial College London).

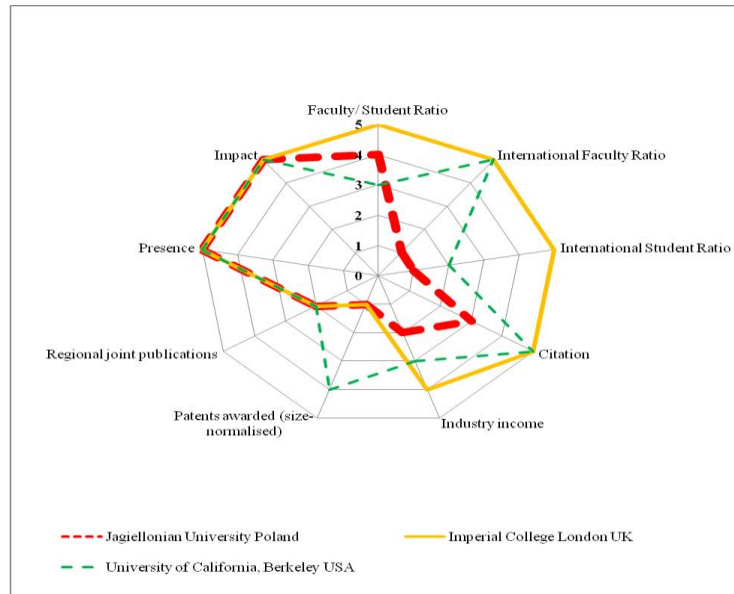


Fig. 6. Comparing the value of the Jagiellonian University with the benchmarks

Source: own elaboration

As Fig. 6 shows, the Jagiellonian University significantly diverges unfavourably from the benchmarks considering such factors (criteria) as: International Faculty Ratio, International Student Ratio, Citation and Industry Income. On the other hand, the following factors are at a much the same level: Regional Joint Publications, Presence and Impact.

On the basis of the comparative analysis done, it is concluded that the biggest weakness of the Jagiellonian University (and the majority of public universities in Poland) is the low level of internationalisation, research and knowledge transfer. These factors contribute to the low value of universities in Poland most.

6.3. Applying radar charts to evaluate organisations (universities) from the viewpoint of various groups of stakeholders

For the purposes of the research, pilot studies in one of the groups of university stakeholders were carried out. The pilot studies were aimed at: verifying the opinion on the correctness of the research tool that will be used in the relevant research; verifying the level of understanding of the research tool; and obtaining an opinion on the importance of selected factors creating the value of universities.

A simplified expert method was applied in which academic teachers were recognized as experts. The research was conducted using a structured interview. 16 academic teachers, including 9 women and 7 men, took part in the research. The most numerous group consisted of people with the academic degree of doctor (13 persons) and habilitated doctor (1 person), who were research and teaching staff (14 persons). Academic teachers with Master's degrees (2 persons) were teaching staff. The largest group consisted of people aged 35-44 (10 persons), 3 experts were either under 34 or over 45, with seniority of mostly 11 to 20 years (9 persons). 10 out of the 16 examined academic teachers do not hold managerial functions at the university, but take part in international (6 persons) and national (3 persons) programs. Half of the experts give lectures/classes in a foreign language, cooperate with industry partners and have publications with partners from the country (7 persons), from abroad (4 persons), from industry (2 persons), and from the region and public administration (1 person). It should be noted that some people declared cooperation with several types of partners. 15 out of 16 teachers, said they had not obtained any patents.

Considering the average weights of individual factors (criteria) that were proposed by academic teachers (Fig. 8), one may state that 'Citation' and 'Patents awarded (size-normalized)' are most important, and 'ISR' and 'IFR' are least important. It should be added that the average weights of individual factors (criteria) differed depending on the academic teachers' age (Fig. 7) and gender (Fig. 8).

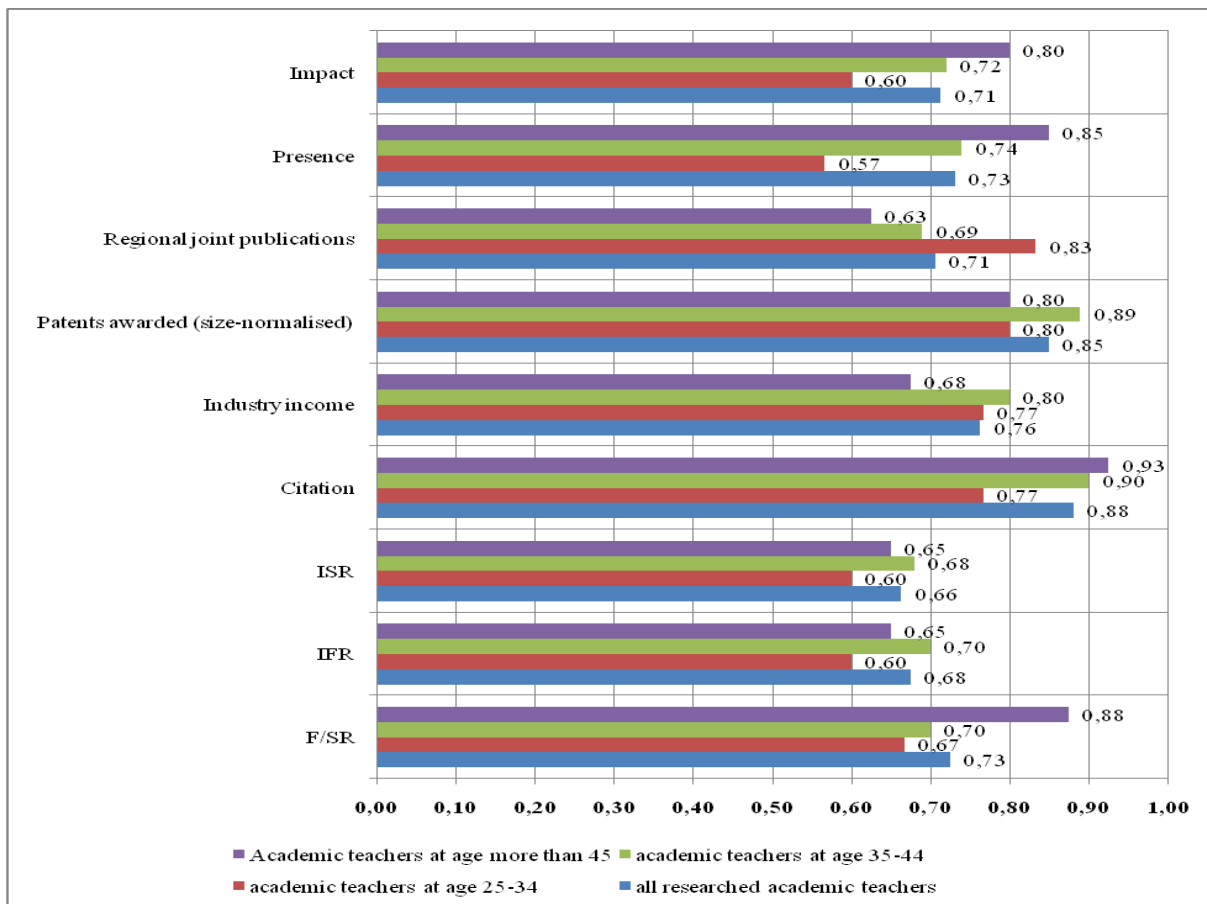


Fig. 7. Average weights of individual factors (criteria) depending on academic teachers' age.

Source: own elaboration

The data contained in Fig. 7 show that in the opinion of the youngest group of academic teachers, most of the analysed factors (criteria) constituting the value of a university are of low value as the group rated these factors relatively low. Academic teachers from the 35-44 age group rated 'IFR', 'ISR', 'Industry Income' and 'Patents awarded (size-normalized)' the highest of all age groups, while academic teachers from the age group over 45 attributed the highest rating to the following factors (criteria): 'F/SR', 'Citation', 'Presence' and 'Impact', and the lowest ratings to: 'Industry income', 'Patents awarded (size-normalized)' and 'Regional joint publications'.

Fig. 8 shows differences in academic teachers' opinions according to gender.

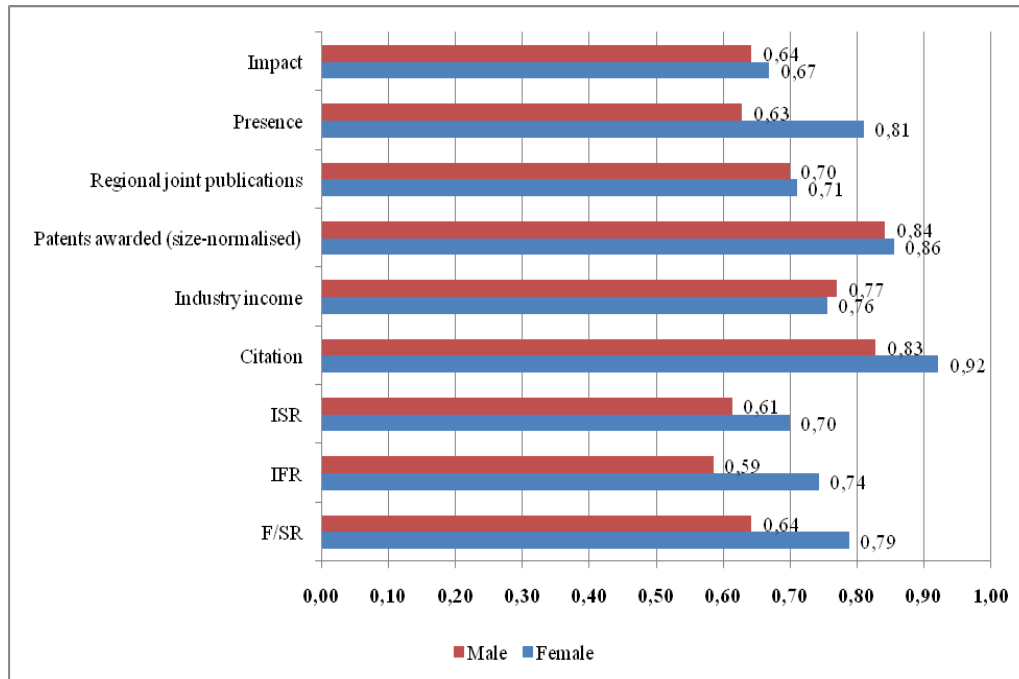


Fig. 8. Average weights of individual factors (criteria) depending on academic teachers' gender.

Source: own elaboration

As observed in Fig. 8, female teachers valued the majority of the studied factors (criteria) higher than male teachers. From the point of view of all teachers, 'Citation' and 'Patents awarded' were the most valued factors; from the viewpoint of both genders, it was 'ISR' that was the factor of the lowest value; women rated 'Impact' (0.67) lowest and in the case of men the lowest rating was obtained by 'IFR' (0.59).

The distribution of weights of selected factors creating the value of universities differ also depending on the position academic teachers hold at the university (Fig. 9).

It can be observed that academic teachers holding managerial positions rated 'Citation' highest while non-managerial teachers found 'Patents awarded' as the most important criterion. 'Citation' is nowadays one of the most important factors for all academic teachers in Poland because of the intense pressure on academic staff for publications in the best and highest indexed international journals. It is connected with government policy which requires improving scientific impact of academic staff from higher education institutions.

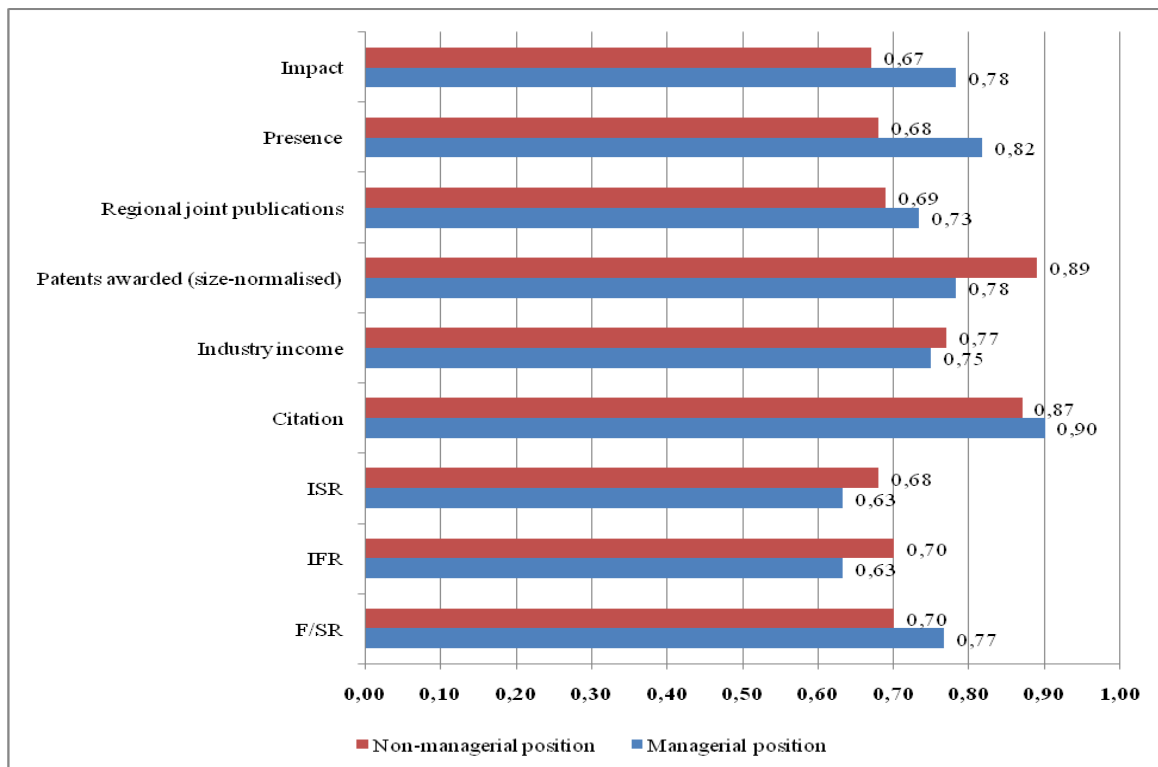


Fig. 9. The average weights of individual factors (criteria) depending on the position of academic teachers at the university (managerial/non-managerial).

Source: own elaboration

Taking into consideration all evaluated factors (criteria), one should conclude that the least important factors for academic teachers holding managerial positions appear to be those related to the internationalization of universities' teaching activity. Numerical indicators describing the ratio of the number of foreign students to total students (ISR) and foreign teachers to total academic teachers (IFR) were rated relatively low by them.

The research let us obtain academic teachers' opinions on the distribution of the weights of selected factors creating the value of universities. That allowed us to make the calculation of the value of the university on the example of the Jagiellonian University analysed in this article. The results are shown in Table 6 and in Fig. 10.

Table 6. Evaluation of factors (criteria) from the point of view of academic teachers as an example of a group of university stakeholders

Jagiellonian University	F/SR	IFR	ISR	Citation	Industry income	Patents awarded (size-normalised)	Regional joint publications	Presence	Impact	Value
Weight	0.7	0.7	0.7	0.9	0.8	0.9	0.7	0.7	0.7	-
Objective level	4	1	1	3	2	1	2	5	5	23.462
Weighted (subjective) level	2.8	0.7	0.7	2.7	0.8	0.9	1.4	3.5	3.5	12.313

Source: own elaboration

The data presented in Table 6 show the weights of chosen factors and weighted (subjective) levels of these factors. The weights represent the average arithmetic weights obtained in the conducted research.

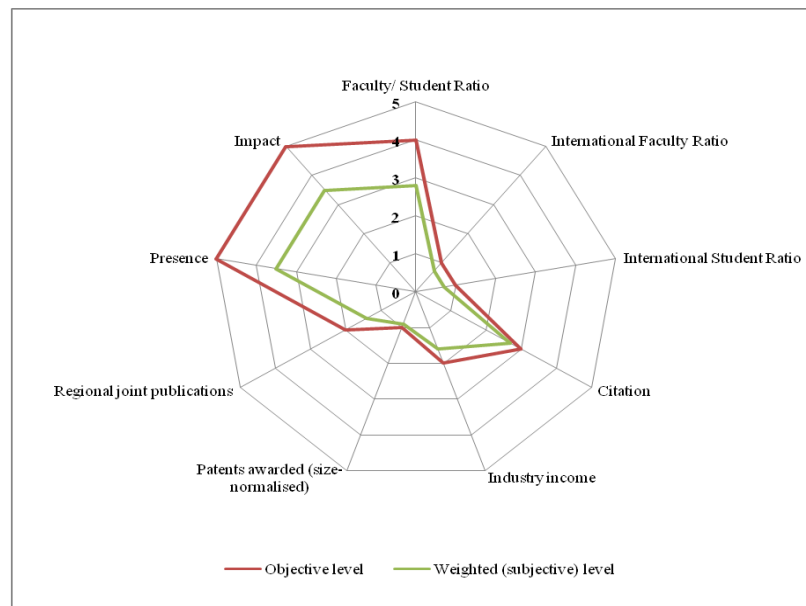


Fig. 10. The comparison of the objective value of the Jagiellonian University with the subjective (weighted) value calculated from the point of view of academic teachers as a group of stakeholders

Source: own elaboration

The data presented in the form of a radar chart (Fig. 10) clearly illustrate the differences between the objective (measurable) value of the analysed university and the subjective value of this university from academic teachers' viewpoint.

It must be clearly noted that the full research that would allow us to apply radar charts to evaluate organisations (universities) from the viewpoint of various groups of stakeholders has not been done yet. What should be done first is primary research that would make it possible to assess the weight of individual factors (criteria) for each group of university stakeholders.

The move is important due to the fact that students, employers, academic staff, university authorities, society and the country as a whole may choose different factors (criteria) that create university value for them. Moreover, they may weigh the factors differently. That is why that way of evaluating a university may lead to a completely different value.

Yet, at the present stage it is possible to say that the application of weights (e.g. according to a scale from 0 to 1) would make it possible to calculate the value of universities from the perspective of each group of stakeholders. Comparing the values of universities, calculated taking into account the weights, would illustrate the subjective value of measurable (objective) factors (criteria) that constitute that value.

It should be emphasized that for the needs of this paper, the most important task was to obtain answers to questions about the weight of individual factors (criteria) constituting the value of the university. However, no research was conducted to identify the factors that are actually the most important from the point of view of academic teachers. The article focuses on presenting and testing a tool that can be used to assess the university value, and not on a full assessment of this value from the point of view of any group of stakeholders. That is why the aforementioned assumptions on the weights of individual factors (criteria) from the viewpoint of academic

teachers are preliminary. The evaluation of universities from the point of view of various groups of stakeholders will be investigated in a separate study.

Conclusions

The research done allows us to claim that radar charts contribute to the measurement and comparison of the value of such organisations as universities. The hypothesis formulated in the introduction assuming that radar charts can be used in various areas of analysing the value of organisations has been positively verified.

The studies carried out with the use of radar charts and mathematical formulas for the surface area of irregular polygons make it possible to:

- measure the value of an organisation (university) (dynamic);
- make multi-criteria comparisons of organisations (universities) - all organisations (universities) subject to the study; organisations (universities) from the same country; an organisation (university) in comparison with the benchmarks;
- evaluate an organisation (university) from the point of view of various groups of stakeholders.

However, it is appropriate to say here that despite certain drawbacks of radar charts as such, it is possible to make the measurements and comparisons of the value of organisations (universities) objective by introducing:

- a. Levels (on a five-point scale from 1 to 5) and corresponding ranges of factors (criteria) taken into account in the analyses. Making the move lets us normalise the values along all axes of a radar chart.
- b. Weights assumed for each factor (criterion) that allow us to identify the most and least important factors (criteria) from the point of view of individual groups of stakeholders (e.g. on a scale up to 1.00). The move will make it possible to measure the value of organisations (universities) from the point of view of selected stakeholders.
- c. Limited number of organisations (universities) presented on a single chart (up to 3). The example of Fig. 4 shows that a larger number of universities would lead to an unclear chart.
- d. Limited number of factors (criteria) for comparisons (from 3 to 12). If the number of factors is too high, the chart loses transparency. In the paper it is assumed that an optimal range of the number of factors (criteria) to measure the value and compare organisations (universities) is between 5 and 12.

The research done let the author develop the following procedure of measuring the value of an organisation with radar charts and mathematical formulas for the surface area of an irregular polygon:

1. Identification of factors (criteria) constituting the value of a given type of an organisation (financial, non-financial, measurable, non-measurable, qualitative, quantitative).
2. Selection of a set of factors (criteria) that will be subject to the relevant analysis. It is possible to make a set of various types of factors (financial and/or non-financial and/or measurable and/or non-measurable and/or qualitative and/or quantitative).
3. Determination of the number of levels, e.g. from 1 to 5. It is possible to modify the number of levels, as appropriate.
4. Comparison of the real values of selected factors (criteria) for all organisations subject to the analysis (Table 3).
5. Formation of ranges corresponding with the real values of the factors (criteria) from stage 4 selected for the analyses, taking into account the number of levels determined in stage 3 (Table 1). Stages 4 and 5 can be applied interchangeably, depending on the purpose of the research done.
6. Transformation of the real values of selected factors (criteria) into the levels corresponding to them (Table 4).

7. Application of radar chart(s) illustrating the factors (criteria) selected for the analysis and levels corresponding to them to all organisations taken into account in the comparison (statistical and/or dynamic) (figures 2-6).
8. Attachment of weights, e.g. on a scale up to 1.00, to each of the factors (criteria) when the analysis refers to the value of organisations from the point of view of various groups of stakeholders (Fig. 10).
9. Application of the mathematical formula for the surface area of an irregular polygon to calculate the value of each of the organisations.
10. Comparison of the value of each organisation depending on the purpose of the research done (measurement of the organisation value (dynamic as well); multi-criteria comparisons of organisations; evaluation of organisations from the point of view of various groups of stakeholders).

As a result of this paper, there will be a measurement and comparison of the value of organisation external environment components, as in the author's opinion, it is possible to apply the presented procedure to strategic management in order to enrich the methods of strategic analysis of the external and internal environments.

References

- Allen, M. 2009. *Expanding the Value of Corporate Universities: The Stakeholder Approach*, in *Dynamic Learning Networks*. http://dx.doi.org/10.1007/978-1-4419-0251-1_7
- ARWU. 2018. *Methodology*. Retrieved from <http://www.shanghairanking.com/Shanghairanking-Subject-Rankings/Methodology-for-ShanghaiRanking-Global-Ranking-of-Academic-Subjects-2018.html>
- Austen, A., Kotas, M. 2016. Wykorzystanie kluczowych czynników sukcesu w procesie zarządzania strategicznego w ośrodkach pomocy społecznej w Polsce – wyniki badań empirycznych. (Use of critical success factors in the process of strategic management in the social aid organisations in Poland – results of empirical research). *Zarządzanie i Finanse Journal of Management and Finance*, 14(2/1): 45-57. Retrieved from http://zif.wzr.pl/pim/2016_2_1_4.pdf
- Bartkowiak, R. 2008. *Historia Myśli ekonomicznej. (History of Economic Thought)*. Polskie Wydawnictwo Ekonomiczne, Wartość, Encyklopedia Zarządzania. Retrieved from <https://mfiles.pl/pl/index.php/Warto%C5%9B%C4%87>
- Benneworth, P., Jongbloed, B.W. 2010. Who matters to universities? A stakeholder perspective on humanities, arts and social sciences valorisation. *Higher education*, 59(5): 567-588. DOI: <https://doi.org/10.1007/s10734-009-9265-2>
- Berzkalne, I., Zelgalve, E. 2014. Intellectual Capital and Company Value. *Procedia - Social and Behavioral Sciences*. 110. <https://doi.org/10.1016/j.sbspro.2013.12.934>
- Bombiak, E. 2014. Kompetencje pracownicze – istota, pomiar i sprawozdawczość. (Employee Competence – the essence, the measurement and reporting). *Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach Seria: Administracja i Zarządzanie*, 103: 173-191. Retrieved from https://repozytorium.uph.edu.pl/bitstream/handle/11331/446/Bombiak.E_Kompetencje_pracownicze.pdf?sequence=1
- Broadbent, J. 2007. If You Can't Measure It, How Can You Manage It? Management and Governance in Higher Educational Institutions. *Public Money & Management*, 27(3): 193-198. [10.1111/j.1467-9302.2007.00579.x](https://doi.org/10.1111/j.1467-9302.2007.00579.x)
- Chapleo, Ch., Sims, Ch. 2010. Stakeholder analysis in higher education. *Perspectives*, 14(1): 12-20. <https://doi.org/10.1080/13603100903458034>
- Coates, H. 2008. Australia, What's the Difference? A Model for Measuring the Value Added by Higher Education. Paris: OECD. Retrieved from <http://www.oecd.org/site/eduimhe08/41218094.pdf>
- Conrad, C.F., Serlin, R.C. (Eds.). 2006. *The SAGE Handbook for Research in Education: Engaging Ideas and Enriching Inquiry*. Thousand Oaks-London-New Delhi: SAGE Publications. <http://dx.doi.org/10.4135/9781412976039>

- Czapiewski, B. 2010. Wykresy, których należy unikać. (Charts to avoid). *Skuteczne raporty*. Retrieved from <https://skuteczneraporty.pl/blog/wykresy-ktorych-nalezy-unikac/>
- Dill, D., Soo, M. 2005. Academic Quality, League Tables, and Public Policy: A Crossnational Analysis of University Rankings. *Higher Education*, 49: 495-533. <https://doi.org/10.1007/s10734-004-1746-8>
- Encyklopedia PWN. *Wartosciowanie*. (Valuing) Retrieved at 20.06.2019 from <https://encyklopedia.pwn.pl/haslo/wartosciowanie;3994138.html>
- European Commission. 2018. *In-depth Report: Indicators for Sustainable Cities*. Issue 12. ISBN: 978-92-79-85127-8, ISSN: 2363-2798, DOI: <https://doi.org/10.2779/121865>. Retrieved from http://ec.europa.eu/environment/integration/research/newsalert/pdf/indicators_for_sustainable_cities_IR12_en.pdf
- Fazlagić, J. 2012. *USP szkoły wyższej, (Unique selling position of a higher school)*, in M. Kaczmarczyk (Ed.). *Uczelnie w przestrzeni publicznej. Zarządzanie, marketing, public relations*. Sosnowiec: Oficyna Wydawnicza Wyższej Szkoły Humanitas, 301. ISBN: 9788361991502.
- Filipowicz, G. 2004. *Zarządzanie kompetencjami zawodowymi. (Management of professional competence)*. Warszawa: PWE, 125. ISBN: 83-208-1532-0.
- Friendly, M. 1991. *Statistical Graphics for Multivariate Data*. Paper presented at the SAS SUGI 16 Conference, April. Retrieved from <http://www.math.yorku.ca/SCS/sugi/sugi16-paper.html>
- Girdzijauskaite, E., Radzeviciene, A., Jakubavicius, A. 2019. Impact of international branch campus KPIs on the university competitiveness: FARE method. *Insights into Regional Development*, 1(2): 171-180. [https://doi.org/10.9770/ird.2019.1.2\(7\)](https://doi.org/10.9770/ird.2019.1.2(7))
- Griffith, A., Rask, K. 2007. The Influence of the US News and World Report Collegiate Rankings on the Matriculation Decision of High-ability Students: 1995-2004. *Economics of Education Review*, 26: 244-255. (CHERI Working Paper #76). Retrieved from Cornell University, ILR School site: <http://digitalcommons.ilr.cornell.edu/cheri/29/>
- GUS. 2019. *Szkolnictwo wyższe w roku akademickim 2018/2019. (Higher education in the academic year 2018/2019)*. Retrieved from <https://stat.gov.pl/obszary-tematyczne/edukacja/edukacja/szkolnictwo-wyzsze-w-roku-akademickim-20182019-wyniki-wstepne,8,6.html>
- Hazelkorn, E. 2007. Impact and Influence of League Tables and Ranking Systems on Higher Education Decision-Making. *Higher Education Management and Policy*, 19(2), OECD Publishing, Paris. Retrieved from https://www.oecd-ilibrary.org/education/higher-education-management-and-policy/volume-19/issue-2_hemp-v19-2-en
- Hazelkorn E. 2008. Learning to Live with League Tables and Ranking: The Experience of Institutional Leaders. *Higher Education Policy*, Vol. 21, Palgrave Macmillan, Basingstoke: 193-215. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.694.2743&rep=rep1&type=pdf>
- Kowalczyk, S. 1986. Filozoficzne koncepcje wartości. (The Philosophical Concepts of Value). *Collectanea Theologica* 56/1: 37-51. Retrieved from http://bazhum.muzhp.pl/media/files/Collectanea_Theologica/Collectanea_Theologica-r1986-t56-n1/Collectanea_Theologica-r1986-t56-n1-s37-51/Collectanea_Theologica-r1986-t56-n1-s37-51.pdf
- Krasuska-Korzeniec, M. 2003. Wartości ważne, choć niewymierne. (Values important, though not measurable). *Gazeta Uniwersytecka US*, nr 3 (113) Grudzień. Retrieved from <http://gazeta.us.edu.pl/node/219431>
- Kwiek, M. 2018. Ustawa 2.0 a mierzalność i porównywalność osiągnięć naukowych. (The Law 2.0 vs. the measurability and comparability of academic output). *Nauka* 1: 65-86. Retrieved from http://cpp.amu.edu.pl/wp-content/uploads/2018/06/Nauka_Kwiek_Ustawa2.0_2018.pdf
- Lake, N., Hickley, K. 2005. *Poradnik obsługi klienta. (Customer service guide)*. Gliwice: Wyd. Helion, 215. ISBN: 83-7361-815-5.
- Leśniewski, M.A. 2011. *Konkurencyjność przedsiębiorstw. Wybrane problemy. (Competitiveness of enterprises. Selected problems)*. Toruń: TNOiK, 232. ISBN: 978-83-7285-568-8.
- Lipska, E., Bojanowska, A. 2009. *Student jako klient szkoły wyższej, (Student as a higher school customer)*, in B. Domańska-Szaruga (Ed.). *Budowanie relacji z klientem*. Warszawa: Wyd. Studio Emka, 245. ISBN 978-83-60652-45-9.

Marginson, S. 2009. The Knowledge Economy and Higher Education: Rankings and Classifications, Research Metrics and Learning Outcomes Measures as a System for Regulating the Value of Knowledge. *Higher Education Management and Policy*, 21(1), OECD Publishing, Paris: 1-15. <https://doi.org/10.1787/17269822>. Retrieved from https://www.oecd-ilibrary.org/education/higher-education-management-and-policy/volume-21/issue-1_hemp-v21-1-en

Marshall, S.J. 2018. *Internal and External Stakeholders in Higher Education*, in *Shaping the University of the Future*. Springer, Singapore, 77-102. https://doi.org/10.1007/978-981-10-7620-6_4

Matematyka.pisz.pl. *Pole trójkąta. (Triangle area)*. Retrieved from <http://matematyka.pisz.pl/strona/503.html>

Mayr von, G. 1877. *Die gesetzmässigkeit im gesellschaftsleben* Tom 23 z Die Naturkräfte. Eine naturwissenschaftliche Volksbibliothek, R. Oldenbourg, 1877, 354. Harvard University, 17.07.2008.

Minkiewicz, B. (Ed.). 2003. *Uczelnie i ich otoczenie: możliwości i formy współdziałania. (Universities and their surroundings: possibilities and forms of cooperation)*. Warszawa: Szkoła Główna Handlowa OFICYNA, 162. ISBN: 83-7378-046-1.

Mitchell, R.K., Agle, B.R., Wood, D.J. 1997. Toward a Theory of Stakeholder. Identification and Salience: Defining the Principle of Who and What Really Counts. *Academy of Management Review*, 22(4): 853-886. <http://dx.doi.org/10.5465/AMR.1997.9711022105>.

Multan, E., Wójcik-Augustyniak, M. 2016. Research Methodology of Entrepreneurship and Innovativeness of Higher Education Institutions. *Edukacja Ekonomistów i Menedżerów. Problemy. Innowacje. Projekty*, 42(4): 83-98. <https://doi.org/10.5604/01.3001.0009.5493>

Näslund, D., Olsson, A., Karlsson, S. 2006. Operationalizing the Concept of Value – an Action Research-Based Model. *The Learning Organization*, 13(3): 300-332. <https://doi.org/10.1108/09696470610661135>

Naylor, R. 2016. *Measuring the Value of Museums: Options, Tips And Benefits*, in *Raport: Money Matters: the Economic Value of Museums*: 27-29. Retrieved from <https://www.nck.pl/badania/raporty/raport-money-matters-the-economic-value-of-museums>

New World Encyclopedia. 2016. *Philosophical theories of Value*. Retrieved from http://www.newworldencyclopedia.org/entry/Value,_Philosophical_theories_of

Novak, J.D., Gowin, D.B. 1984. *Learning How to Learn*. Cambridge University Press. <https://doi.org/10.1017/CBO9781139173469>

Nowodziński, P. 2011. Nowoczesne koncepcje zarządzania szkołą wyższą, (Modern concepts of higher school management), in Sz. Cyfert, C. Kochalski (Eds.). *Projektowanie i wdrażanie strategii rozwoju w publicznych szkołach wyższych w Polsce - aspekty teoretyczne i praktyczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Poznaniu*, t. 167: 23-35.

Odds, G. 2011. A Critique of Radar Charts. *Scott Logic*. Retrieved at 22.06.2019 from <https://blog.scottlogic.com/2011/09/23/a-critique-of-radar-charts.html>

Osborne H. 2016. *Foundations of the Philosophy of Value: An Examination of Value and Value Theories*. Cambridge University Press, 132.

Perło D. 2014. Wykorzystanie metod analizy strategicznej przedsiębiorstw w budowie strategii rozwoju jednostki terytorialnej. (The Tools of Strategic Enterprise Analysis in the Development Strategy of Local Government Units). *Studia i Prace Kolegium Zarządzania i Finansów*; 135 (1): 77-88. Retrieved from http://kolegia.sgh.waw.pl/pl/KZiF/czasopisma/zeszyty_naukowe_studia_i_prace_kzif/Documents/135.pdf

Piotrowska-Piątek, A. 2016. Analiza interesariuszy zewnętrznych szkół wyższych – identyfikacja i ocena ich znaczenia przez szkoły wyższe. (An analysis of external stakeholders in higher education institutions: The schools' identification and assessment of the stakeholders' impact). *Zarządzanie Publiczne* 2(36): 85-93. ISSN 1898-3529 <https://doi.org/10.15678/ZP.2016.36.2.06>

QS World University Rankings. 2019. *Methodology*. Retrieved from <https://www.topuniversities.com/qs-world-university-rankings/methodology>

Radar Chart. 2019. Retrieved at 15.06.2019 from <http://visualizationuniverse.com/charts/>

Ravald, A, Gronroos, Ch. 1996. The Value Concept and Relationship Marketing. *European Journal of Marketing*, 30(2): 19-30. <https://doi.org/10.1108/03090569610106626>

Salmi, J., Saroyan, A. 2007. League Tables as Policy Instruments. *International Higher Education*, 47, CIHE, Chestnut Hill: 2-4. Retrieved from https://www.bc.edu/content/dam/files/research_sites/cihe/pdf/IEpdfs/ihe47.pdf

Schierenbeck, Ch. 2012. *Fixing Higher Education: A Business Manager's Take on How to Boost Productivity in Higher Education*. Springer Science & Business Media, 244. ISBN 3658002131, 9783658002138.

Schlissel, M.S., Schill, M.H., Drake, M.V. 2018. *3 vital ways to measure how much a university education is worth*. Retrieved from <http://theconversation.com/3-vital-ways-to-measure-how-much-a-university-education-is-worth-94208>

Smith, G., Parr, R. 2005. *Intellectual Property: Valuation, Exploitation, and Infringement Damages*, 4th Edition. Wiley, 888. ISBN: 978-0-471-68323-0.

Sułkowski, Ł. 2008. Interpretacyjny paradygmat strategii organizacyjnej, (The interpretative paradigm of organizational strategy), in R. Krupski (Ed.), *Zarządzanie strategiczne. Podstawowe problemy*. Wałbrzych: *Prace Naukowe Wałbrzyskiej Wyższej Szkoły Zarządzania i Przedsiębiorczości, Seria: Zarządzanie*. Retrieved from https://wvzip.pl/wp-content/uploads/2017/07/12_Zarządzanie_strategiczne_Podstawowe_problemy_Krupski_2008.pdf

The Value Proposition's Double Meaning. 2019. *Lawlor Focus*. Retrieved from <https://lawloradvisory.com/the-value-propositions-double-meaning/>

Tremblay, K., Lalancette, D., Roseveare, D. 2012. Assessment of Higher Education Learning Outcomes. AHELO Feasibility Study Report. Volume 1 Design and Implementation. Retrieved from <http://www.oecd.org/education/skills-beyond-school/AHELOFSReportVolume1.pdf>

U-Multirank. 2019. *Methodology*. Retrieved from <https://www.umultirank.org/about/methodology/indicators/>

United Nations. 2019. *Methodology*. Retrieved from *Standard country or area codes for statistical use (M49)*: <https://unstats.un.org/unsd/methodology/m49/>

Vught Van, F. (Ed.) 2009. *Mapping the Higher Education Landscape, towards a European Classification of Higher Education*. Dordrecht: Springer, 170. DOI: <https://doi.org/10.1007/978-90-481-2249-3>

Vught Van, F., Ziegele, F. 2012. *Multidimensional Ranking: The Design and Development of U-Multirank*. Dordrecht: Springer, 179-189. https://doi.org/10.1007/978-94-007-3005-2_11

Waks, L.J. 2016. *The Evolution and Evaluation of Massive Open Online Courses: MOOCs in Motion*. The Cultural and Social Foundations of Education, Springer, 136. ISBN 134985204X, 9781349852048.

Webometrics. 2019. *Methodology*. Retrieved from <http://www.webometrics.info/en/Methodology>

Wiederhold, G. 2014. *The Value of Intellectual Capital*, in *Valuing Intellectual Capital. Management for Professionals*. New York, NY: Springer, 563.

Wilkin, J. 2009. *Ekonomiczno-finansowe uwarunkowania rozwoju szkolnictwa wyższego w Polsce, (Economic and financial conditions for the development of higher education in Poland)*, in R.Z. Morawski. *Polskie szkolnictwo wyższe. Stan, uwarunkowania, perspektywy*. Warszawa: Wydawnictwo Uniwersytetu Warszawskiego, 284. ISBN: 978-83-235-0567-9 Retrieved from https://www.frp.org.pl/pliki/Strategia_all_pass.pdf

World Population Review 2019. Retrieved from <http://worldpopulationreview.com/countries/eastern-europe-countries/>

Wróblewski A.K. 2013. Pozycja nauki polskiej w międzynarodowych rankingach. (Polish science in international rankings). *Studia BAS*, 3 (35). Biuro Analiz Sejmowych: 89-106. Retrieved from http://orka.sejm.gov.pl/wydbas.nsf/0/59106DE53D3E5673C1257BDC0029AC5E/%24File/Strony%20odStudia_BAS_35i-5.pdf

Zeithaml, V.A. 1988. Consumer Perception of Price, Quality and Value: A Means-End Model and Synthesis of Evidence, *Journal of Marketing*, 52(3 (Jul.)): 2-22. Retrieved from https://www.researchgate.net/profile/Valarie_Zeithaml/publication/245704883_Communication_and_Control_Processes_in_the_Delivery_of_Service_Quality/links/558829a608aeb76aaa009e54/Communication-and-Control-Processes-in-the-Delivery-of-Service-Quality.pdf

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