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EFFICIENCY OF EDUCATION OF STUDENTS WITH DISABILITIES AT ACADEMIC INSTITUTION IN POLAND

The aim of this article is to describe the effectiveness of the education process of people with disabilities in terms of the division into the types of higher education and taking into account the territorial division in 2014-2016. On the one hand, the research group of the analysis consisted of aggregated data for particular types of schools, and on the other – summary data for individual provinces. Empirical research was carried out using advanced instrumentation in the form of a non-parametric DEA method for the needs of which four analytical models were specified. Finally, the results allowed to compare the level of education effectiveness depending on the type of higher education and within provinces, and, in both cases, rankings were created depending on the results obtained.

Keywords: effectiveness, DEA method, people with disabilities.

Цвьонкала-Малис А., Лаговські П. ЕФЕКТИВНІСТЬ НАВЧАННЯ СТУДЕНТІВ З ОБМЕЖЕНИМИ МОЖЛИВОСТЯМИ В НАВЧАЛЬНОМУ ЗАКЛАДІ В ПОЛЬЩІ

З 2011 р. навчально-наукові установи Польщі зобов'язані створювати умови для студентів-інвалідів для їх повної участі як в процесі навчання, так і в наукових дослідженнях. Метою статті є дослідження ефективності навчального процесу у вищих навчальних закладах людей з інвалідністю з точки зору розподілу за видами вищої освіти та врахування територіального розподілу навчальних закладів у Польщі в період з 2014 по 2016 рр. Для дослідження використовувався емпіричний матеріал з офіційних звітів Центрального статистичного управління. З одного боку, було згруповано та проведено аналіз даних, агрегованих для окремих типів шкіл за ознакою їх професійного спрямування, а з іншого – досліджено зведені дані для окремих воєводств. Емпіричне дослідження проводилося з використанням непараметричного аналізу середовища функціонування (Data Envelopment Analysis) – методу DEA, для потреб якого було виділено чотири аналітичні моделі. Нарешті, результати дозволили порівняти рівень ефективності освіти залежно від виду вищої освіти та в межах воєводств, і в обох випадках були створені рейтинги залежно від отриманих результатів. Комунікація, залучення людей з обмеженими можливостями до суспільного життя відбувається шляхом ефективної освіти. Проведені дослідження показують, що рівень ефективності аналізованих явищ мени диференційований за територіальною ознакою (результати за воєводствами демонструють меншу варіативність), ніж у вибірці, здійсненій відповідно до видів вищих навчальних закладів. У цій сфері необхідно підвищити ефективність освіти людей з особливими потребами. Щобільше, підвищення ефективності освіти є необхідним, оскільки це питання добробуту, адже люди з інвалідністю мають ті самі права, що й інші. Водночас інваліди, які мають повну освіту, можуть знайти кращу оплачувану роботу та бути більш незалежними фінансово, а це означає зменшення витрат Державного бюджету. Варто пам'ятати, що підвищення ефективності навчання відповідно до прийнятих моделей буде можливим, коли таких випускників буде більше. Окрім того, навчання вимагає індивідуального ставлення до конкретної людини, з визначенням її труднощів і спільного рішення щодо їх подолання. Тільки таке ставлення та відповідний системний підхід дозволить підвищити рівень ефективності навчання людей з обмеженими можливостями.

Ключові слова: ефективність, метод DEA, люди з обмеженими можливостями.

Introduction

There is not one definition of disability. The World Programme of Action for Disabled Persons and The Standard Rules on the Equalization of Opportunities for Persons with Disabilities say that disability is a social problem and does not restrict to only one person. Writing about disabilities we have in mind 'a relationship between human's health (taking into account his age, sex and education) and a society and environment that is around»[6].

13.12.2006 General Assembly of United Nations accepted unanimously a convention on the rights of disabled people. Its text was agreed on in 2006.

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[6]

http://www.unic.un.org.pl/niepelnosprawnosc/definicja.php

The convention on the rights of disabled people is the earliest agreed on from human rights in the history of United Nations. It is the first convention generally accepted in the twenty first century. From 02.12.2005 it became obligatory in Poland, it was ratified by our country. A Convention 159 of International Labour Organization referring to occupational rehabilitation and employment of disabled people was accepted in Geneva on 20.06.1983.

A place of disabled people in the society was strictly specified by the state law. The most important regulations in this area are:

1. Constitution of the Republic of Poland – 'Disabled people are given, according to the law, help in securing their existence, adjustment to work and social communication'.

2. The law on professional and social rehabilitation and employment of disabled people – «Disabled person is a person whose physical and mental condition lastingly inhibits or periodically limits abilities to work. «

This law determines three levels of disability:

- major – here we can classify a person that has infringed body ability, unable to work or able to work or able to work in special and demanding condition as to act a social role, constant or long term care of other people is required because of disability to act a social role.
- moderate – here we can classify a person with infringed body ability, unable to work or able to work only in special conditions or in need of tidal or partial help from other people as to act a social role.
- slight – here we can classify a person with infringed body ability which, in significant way, decreases abilities to work in comparison to a person that has the same qualifications and full physical ability or the one that has some limitations in acting some social roles which can be compensated by various orthopaedic objects, supplementary or technical means.

3. The Rights of Persons with disabilities Act⁻ 'A disabled person is a person whose physical or mental ability enduringly or temporally limits or prevents from normal everyday life, education, work and acting social roles, according to legal and customary norms having the right to independent, self-reliant and active life and cannot be discriminated'.

The Parliament of the Republic of Poland guarantees to disabled people:

1) an access to goods and services allowing for full participation in a social life,

2) an access to health treatment and health service, early diagnostics, rehabilitation health education but also health benefits including a type and a level of disability, including submission of orthopaedic objects, supplementary means and assistive device,

3) an access to versatile rehabilitation in order to allow social adaptation,

4) an access to education together with able peers and also to use special education or individual one,

5) an access to psychological, pedagogical and other special support that enables a development,

achievement or upgrading of qualifications general and professional,

6) an access to employment on an open market correspondingly to qualification, education and possibilities of using professional consulting and broking and when disability and health state requires – the right to work in conditions adjusted to the needs of disabled people,

7) an access to social protection including the necessity to incur higher cost resulting from disability and also including these costs in the tax system,

8) an access to existing in the environment free from functional barriers, including:

- offices, voting points and public utility units,
- effortless moving and usage of public transport,
- information,
- interpersonal communication.

In the last years many organizations and institutions have worked on the improvement of disabled people education. Additionally, academic institutions implement many solutions to make it more convenient for disabled people to educate. The awareness is rising that a lack of proper facilities at universities results not only in lowering professional qualifications of the disabled but also in depriving from possibilities to equal the differences in the area of social, communication and professional abilities.

An amendment to 'Act on higher education' defines a significant change in the scope of duties of an academic institution in respect to disabled people.

Since 2011 academic institutions are obliged to 'create conditions for disabled people to fully take part in a process of education and in scientific research'. This kind of regulation not only gives more chances to disabled people who are eager to educate further but also obliges a university to eliminate any obstacles that make it impossible to educate for people with different dysfunctions (Kędzierska).

At the same time we have to agree with M. Kilian, that 'adjusting polish academic institutions to the needs of disabled students entails in the conception of integrate education that requires building a common area for commonalty without regard their health state. Integrate education realized at the academic level is a capstone of the whole education of disabled people, focused, as in case of healthy people, gaining maximum of life independency' (Kilian, 2016, p. 267).

A social context of disability issue was commented by An International Classification of Functioning, Disability and Health – ICF, accepted during World Health Assembly in 2001. According to this 'disability refers to the whole humankind, we cannot put the burden of disability problems on minorities – every human being's health may worsen and the person may become disabled'[7] (United Nations Information Centre).

The aim of the article is an analysis and evaluation of efficiency of disabled students education at Polish academic institutions, including a type of a university and a division. Thus an empirical material was used which was provided by Central Statistical Office for years. For

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[7]

http://www.unic.un.org.pl/niepelnosprawnosc/definicja.php

the analysis quantitive tools were used – it is discussed in the following parts.

A situation of a disabled student in Poland

According to results of National Common Listing of People and Housing from 2011 the number of disabled for the end of March 2011 was 4,7 million (more precisely 4697,0) which constituted 12,2% of all the people in the country (on average every eighth) (Central Statistical Office, 2012, p.63). In 2012 there were 5,5 million of disabled people which constituted 14,3% of people in the country. There were about 46,1% men and 53,9% of women who were disabled. (Central Statistical Office, 2002, p.23).

It is observed that an interest in studying among disabled people is growing. In 2005 there were about 9 thousands interested and in 2007 – almost 20 thousands and in 2010 about 30 thousands. On 30th of November 2016 there were 25 thousands of disabled students (Central Statistical Office, 2017, p.155). Thanks to solutions implemented with a reform on higher education in 2011 academic institutions gained new possibilities to help disabled students (Ministry of Science and Higher Education).

From 2011 academic institutions in Poland are obliged to create conditions suitable for disabled students to fully participate, both in the process of education and in scientific researches. Public universities acquire financial means from the state budget for:

- financing investments for education of disabled students and doctors and also for specialist trainings,
- buying specialist tools, didactic and scientific materials adjusted to the needs of disabled,
- transport between didactic objects of an academic institution.

This financial support depends on a university and a type of studies. It is possible to strive for it both at full-time and part-time programmes at public and non-public institutions. Regardless a special scholarship targeted at disabled people, they may also receive, on the same basis as other students, other financial support e.g. social support, rector's scholarship for the best students, a scholarship for the best doctors, a scholarship form a the Minister for excellent achievements and benefits. Additionally, disabled students and doctors may apply for student's credit with a surcharge to interest rates form a state budget and preferential pay off terms.

An analysis of a research method – frontier data analysis – DEA method

For the evaluation of educational process of disabled people a non-parametric method was used for the need of this study. There is a procedure of linear programming and it does not include the influence of random factor on the efficiency of objects and potential mistakes of a measurement and it does not take into consideration functional dependence of inputs and results.

A DEA method was used for the first time and presented by A. Charnes, W. Cooper and E. Rhodes in 1978 in: *Measuring the efficiency of decision making units*. It was particularly used in researches in technical efficiency of objects such as: educational units (schools, academic institutions) (Bates, 1993; Biswas, Lewis, 2001;

Johnes, 1993; Feng, Lu, Bi, 2004). The authors of a DEA method basing on a productive model created by Debreu (1951) and Farrell (1957) defined a measure of productivity 'as a ratio of a single effect to a single input and used in a situation where there is more than one input and more than one result, so in a multidimensional situation' (Pawłowska, 2003, p. 24).

In a DEA method we can distinguish two functions of an aim:

- maximisation of results, with given inputs,
- minimisation of inputs wit given results.

Solution of the function with the usage of linear programming allows for determining production frontier so called envelope where we can find the most effective units of researched group. In case of units that are on an envelope the measure of effectiveness equals 1, below the envelope the measure of it is less than 1 and indicates a level of ineffectiveness.

In the DEA method objects of analysis are decision making units so for example academic institutions, schools.

In literature of the subject matter it is confirmed that a DMU group should comply with the following requirements (Bowlin, 1998, p. 3-27):

- the number of researched units should be at least three times higher than the number of variables which constitutes of inputs and effects as to guarantee a sufficient number of freedom levels,
- the increase of an input leads to a better effect so there is a sufficient plausible dependency between these variables,
- DMU should be homogenous.

Distinguishing efficiency of DMU consists in solving one of a DEA model. It means that it is a properly created linear programming issue in which decision making units are measures also called multipliers. The solution generates an efficiency rate for a searched DMU. When a DMU is inefficient then a solution determines also a set of standard objects (also called benchmarks[8]) with remaining optimal measures that are assigned and which inform how this inefficient DMU should work – or reduce its inputs or increase its results as to improve the efficiency (Domagała, 2007, p. 23).

The main DEA model with a radial efficiency measure is a model with constant returns to scale. In literature it is also called a CCR model.

This CCR model is the most often used model in scientific researches and in economic practice. It is also a starting point for other DEA approach. In the CCR model efficiency is considered in Farells sense. It is also assumed that a change in efficiency means proportional changes of inputs (in case of input oriented models) or proportional changes of results (in case of results oriented models). The core of frontier and technical efficiency measure in CCR model is present in the Figure 1.

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[8] *Benchmarking* – it is a constant and systematic method of development and it improves performance of a unit by confronting its efficiency measured by productivity, quality and experience with the results of these units and organizations which can be treated as model.
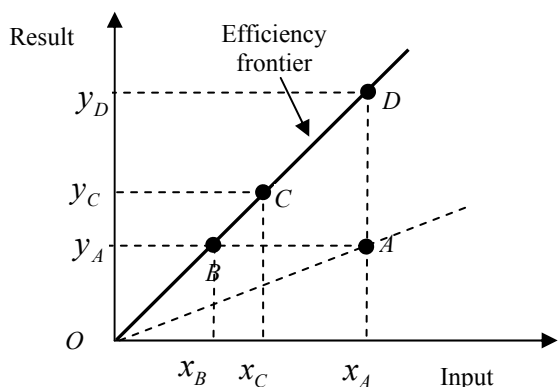
Figure 1. Technical efficiency frontier in a CCR model

Technical efficiency *j*- decision making unit is defined as weighted arithmetic mean of its results to weighted arithmetic mean of its inputs:

$$\sum_{r=1}^{s} \mu_r y_{rj} \Big/ \sum_{i=1}^{m} v_i x_{ij} \, , \qquad (1)$$

where:

variable μ_r – is a measure related to r – result,

variable v_i – is a measure of *i*-input,

x_{ij} – *i*- input used by *j*-decision making unit,

y_{rj} – *r*- result from *j*-unit, whereby: $i = 1, 2, \ldots, m$, $j = 1, 2, \ldots, n$, $r = 1, 2, \ldots, s$.

In a DEA method a basis for technical efficiency measurement is the abovementioned quotient. A problem of maximisation can be defined in two different ways. For a researched unit marked with 0 symbol, a solution is as follows

$$\max \ \sum_{r=1}^{s} \mu_r y_{r0} \Big/ \sum_{i=1}^{m} v_i x_{i0} \, , \qquad (2)$$

With limitations:

$$\sum_{r=1}^{s} \mu_r y_{rj} \Big/ \sum_{i=1}^{m} v_i x_{ij} \le 1 \, , \ \forall \, j \, ,$$
$$\mu_r, v_i \ge 0 \, , \ \forall \, r, i,$$

Or a task

$$\min \ \sum_{i=1}^{m} v_i x_{i0} \Big/ \sum_{r=1}^{s} \mu_r y_{r0} \, , \qquad (3)$$

With limitations:

$$\sum_{i=1}^{m} v_i x_{ij} \Big/ \sum_{r=1}^{s} \mu_r y_{rj} \ge 1 \, , \ \forall \, j \, ,$$
$$\mu_r, v_i \ge 0 \, , \ \forall \, r, i \, .$$

Tasks (2) constitutes a basis for a measure of technical efficiency input oriented, where task (3) allows for distinguishing technical efficiency results oriented.

Analysis of research method – Malmquist Index

In theory and in practice a very significant problem is to compare the changes of efficiency in time. In order to do this Malmquist productivity index is used which was introduced in the article, *Index Numbers and Indifferences Surfaces.*

A Malmquist Index was used to measure productivity at the beginning of the eighties of the twentieth century. Theoretically the basis for using the index was created by D.W. Caves, L.R. Christensen and E.W. Diewert in 1982. In the nineties R. Färe, S. Grosskopf, B. Lindgren and P. Roos created a way to measure with the usage of a DEA method.

A Malmquist productivity index (Ćwiąkała-Małys, Nowak, 2009) is to compare the inputs of a unit with results in two different scope of time according to the following formula

$$M = \frac{y^{t+1} \big/ x^{t+1}}{y^t \big/ x^t} \, , \qquad (4)$$

where:

$y^t \big/ x^t$ – is productivity of a unit at time t,

$y^{t+1} \big/ x^{t+1}$ – is a productivity of a unit in time $t+1$.

If $M < 1$, then productivity of a unit is decreased with time. If $M = 1$ it means that productivity of a unit is constant in time. Productivity of DMU increases when $M > 1$.

Similarly as in efficiency measures there are two productivity indices:

- Malmquist index which is input oriented – differences in productivity come out from differences in minimal inputs needed to produce a given level of results.
- Malmquist index which is results oriented – differences in the productivity is treated as a difference in the level of maximal product for given levels of inputs.

The index is described in a language of a technical efficiency measure that is input oriented:

$$M_I = \sqrt{ \frac{\theta_I^t(x^{t+1}, y^{t+1})}{\theta_I^t(x^t, y^t)} \cdot \frac{\theta_I^{t+1}(x^{t+1}, y^{t+1})}{\theta_I^{t+1}(x^t, y^t)} } \, , \qquad (5)$$

where:

$\theta_I^t(x^{t+1}, y^{t+1}) = f/e$ – technical efficiency which is input oriented of an *A* unit for data from a range $t+1$ and technology in a *t* period determined in a CCR model,

$\theta_I^{t+1}(x^{t+1}, y^{t+1}) = d/e$ – technical efficiency which is input oriented of an *A* unit in a $t+1$ period determined in a CCR model

$\theta_I^t(x^t, y^t) = b/c$ – technical efficiency input oriented of an *A* unit in a *t* period determined in a CCR model,

$\theta_I^{t+1}(x^t, y^t) = a/c$ – technical efficiency input oriented of an *A* unit for data from a *t* period and technology in a $t+1$ period determined in a CCR model.

An idea of construction of a productivity Malmquist index that is input oriented in CCR model is presented in a Figure 2.
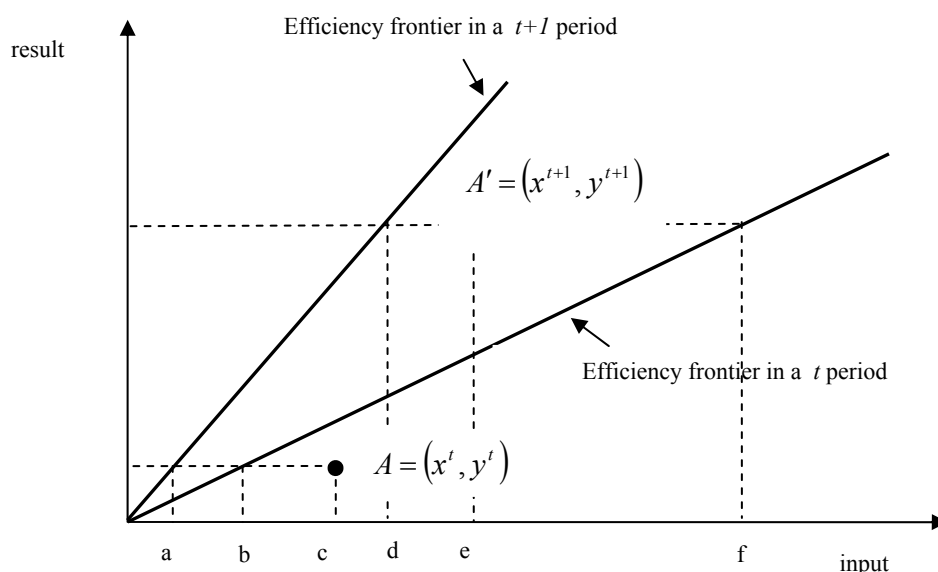

Figure 2. Malmquist productivity index in an input oriented model

Efficiency measure of disabled people education

Operationalization of a researched problem and an approved researched method led to forming two models in two different variants. In a Table 1 a model of efficiency measurement of disabled people efficiency is presented with DMUs that represent types of academic institutions. Input variable in a subject model represents a number of students with disabilities with a result variable determining a number of disabled graduates. Due to data character this model is results oriented with constant returns to scale.

Table 1

Model no. 1 – variant I

A type of a model	Input	Results	Model parameters
Efficiency according to types of universities	Number of students with disabilities	Number of graduates with disabilities	Input oriented model with constant returns to scale (DEA CSR)

In the Table 2 second variant of a model 1 is presented in which a number of variables of inputs – apart from number of students with disabilities additionally a number of special scholarship for disabled people was included.

Table 2

Model no. 1 – variant II

A type of a model	Input	Results	Model parameters
Efficiency according to types of universities	Number of students with disabilities Number of special scholarship for people with disabilities	Number of graduates with disabilities	Results oriented model with constant returns to scale (DEA CSR)

In a model 2, a detailed description of which is included in a Table 3, efficiency is measured taking into consideration an administration division, in particular provinces. The remaining variables and parameters comply with model 1 in a variant 1.

Table 3

Model no. 2 – variant I

A type of a model	Input	Results	Model parameters
Efficiency according to provinces	Number of students with disabilities	Number of graduates with disabilities	Results oriented model with constant returns to scale (DEA CSR)

Second variant of a model no. 2 – presented in a Table 4 – was extended with reference to a number of variables from a model number 1 of about a number of special scholarship for people with disabilities. The remaining parameters stayed without changes.

Table 4

Model no. 2 – variant II

A type of a model	Input	Results	Model parameters
Efficiency according to provinces	Number of students with disabilities Number of special scholarship for people with disabilities	Number of graduates with disabilities	Results oriented model with constant returns to scale (DEA CSR)

The results of an efficiency measurement process of educating people with disabilities were presented in a Table 5 and show that in a researched period of time a model that was used for an analysis identified, in each of analysed year, only one fully efficient unit – in 2014 and in 2016 there were pedagogical universities. Average efficiency in 2014-2016 increased from 0,567 to 0,665 while the minimal efficiency value decreased from 0,246 to 0 (it was connected with the fact that in

2016 schools of higher education that were subordinate to a resort of the interior and administration where the number of students was equal to 0 – DMU – 13).

Table 5

The results of efficiency measurement of disabled people education according to a type universities – model no. 1 variant I

DMU*	Model DEA CRS results oriented, inputs: number of students with disabilities, results: number of graduates with disabilities					
	2014		2015		2016	
	result	ranking	result	ranking	result	ranking
DMU_1	0,616	4	0,386	7	0,710	7
DMU_2	0,513	9	0,353	9	0,721	6
DMU_3	0,542	7	0,445	3	0,669	9
DMU_4	0,699	3	0,462	2	0,787	4
DMU_5	1,000	1	0,444	4	1,000	1
DMU_6	0,590	6	0,360	8	0,699	8
DMU_7	0,249	12	0,207	12	0,866	2
DMU_8	0,599	5	0,336	10	0,741	5
DMU_9	0,494	11	0,388	6	0,564	11
DMU_10	0,246	13	0,205	13	0,514	12
DMU_11	0,800	2	0,428	5	0,804	3
DMU_12	0,503	10	0,227	11	0,570	10
DMU_13	0,526	8	1,000	1	0,000	13
average	0,567		0,403		0,665	
minimum	0,246		0,205		0,000	
average inefficiency	0,531		0,353		0,637	
efficient DMU	1		1		1	

* Description of a DMU is included in an annex in Table A1

Table 6

The results of efficiency measurement of disabled people education according to a type universities – model no. 1 variant II

DMU	Model DEA CRS results oriented, inputs: number of students with disabilities, number of special scholarship for people with disabilities results: number of graduates with disabilities					
	2014		2015		2016	
	result	ranking	result	ranking	result	ranking
DMU_1	0,666	4	0,467	6	0,789	5
DMU_2	0,520	9	0,394	8	0,739	7
DMU_3	0,573	7	0,505	3	0,679	9
DMU_4	0,699	3	0,508	2	0,812	4
DMU_5	1,000	1	0,497	4	1,000	1
DMU_6	0,590	6	0,381	10	0,699	8
DMU_7	0,284	12	0,215	13	0,884	2
DMU_8	0,607	5	0,388	9	0,741	6
DMU_9	0,495	11	0,428	7	0,564	12
DMU_10	0,251	13	0,277	11	0,608	10
DMU_11	0,822	2	0,480	5	0,838	3
DMU_12	0,503	10	0,248	12	0,570	11
DMU_13	0,526	8	1,000	1	0,000	13
average	0,580		0,445		0,686	
minimum	0,251		0,215		0,000	
average inefficiency	0,545		0,399		0,660	
effective DMU	1		1		1	

Compliance, on the side of input variables, number of special scholarship for people with disabilities causes an increase of unit values of an efficiency factor – results were presented in Table 6. Average value, in a researched period, increased from 0,580 to 0,686. It is worth noting that a sharp increase of efficiency in case of

DMU_7 (Maritime universities), which appeared in the ranking on the second place and moved from 12th in 2014.

In a Table 7 results from efficiency measurement were presented, considering territorial division. Average efficiency in the researched period of time increased from 0,659 to 0,723 in 2014-2016 while this model identified again only one efficient unit in each year – however, in each year it was a different unit. Fully efficient provinces were podkarpackie, świętokrzyskie and opolskie.

Table 7

The results of efficiency measurement of disabled people education according to a territorial division – model no. 2 variant I

DMU**	Model DEA CRS results oriented, inputs: number of students with disabilities, results: number of graduates with disabilities					
	2014		2015		2016	
	result	ranking	result	ranking	result	ranking
DMU_1	0,544	15	0,710	12	0,726	7
DMU_2	0,557	14	0,699	13	0,630	12
DMU_3	0,521	16	0,892	4	0,618	14
DMU_4	0,599	11	0,871	5	0,800	5
DMU_5	0,608	10	0,651	16	0,536	16
DMU_6	0,580	12	0,810	7	0,691	8
DMU_7	0,579	13	0,659	15	0,583	15
DMU_8	0,689	5	0,923	3	1,000	1
DMU_9	1,000	1	0,927	2	0,830	3
DMU_10	0,694	4	0,865	6	0,764	6
DMU_11	0,615	9	0,662	14	0,627	13
DMU_12	0,671	6	0,769	9	0,631	11
DMU_13	0,812	2	1,000	1	0,808	4
DMU_14	0,769	3	0,791	8	0,991	2
DMU_15	0,644	8	0,721	11	0,683	9
DMU_16	0,664	7	0,736	10	0,652	10
average	0,659		0,793		0,723	
minimum	0,521		0,651		0,536	
average inefficiency	0,636		0,779		0,705	
effective DMU	1		1		1	

** Description of a DMU is included in an annex in Table A2

The results gained with the usage of a second model in a second variant, correspondingly to the analysis and taking into consideration gradation into types of universities confirm that adding a variable on the side of an input, a number of paid special scholarship for people with disabilities, leads to an increase of gained results – see Table 8. Average efficiency increased in 2014-2016 from 0,690 to 0,725. This model has also multiplied identification of fully effective provinces (pokarpackie, świętokrzyskie and opolskie) accordingly in particular, analysed years.

A Malmquist index allowed to measure a tendency of efficiency increase which was analysed in period of time 2014-2016. Average results of a factor that were obtained on the basis of the first model in a first variant were presented in Figure 3 and do not unambiguously confirm an increase of efficiency in researched types of academic institutions – by contrast to an average measured for given years. Average value of an index is 0,999 – considering 0 value for DMU_13, excluding this types of schools will cause an increase of an average value of an index to 1,082. A distinguishable increase of efficiency was observed in Maritime universities – a Malmquist index reached in this case a value of 1,719.

Table 8

Results of education efficiency of people with disability measurement including territorial division – model 2, variant II

| DMU	DEA CRS model results oriented. Inputs: number of students with disabilities, number of special scholarship for disabled, Results: number of students with disabilities					
	2014		2015		2016	
	result	ranking	result	ranking	result	ranking
DMU_1	0,561	15	0,744	13	0,726	7
DMU_2	0,602	14	0,776	12	0,641	11
DMU_3	0,536	16	0,892	4	0,618	14
DMU_4	0,629	11	0,871	6	0,800	5
DMU_5	0,649	10	0,693	15	0,536	16
DMU_6	0,623	12	0,874	5	0,691	8
DMU_7	0,611	13	0,707	14	0,583	15
DMU_8	0,742	5	0,983	2	1,000	1
DMU_9	1,000	1	0,939	3	0,830	3
DMU_10	0,707	6	0,871	6	0,764	6
DMU_11	0,672	8	0,686	16	0,627	13
DMU_12	0,682	7	0,777	11	0,631	12
DMU_13	0,812	3	1,000	1	0,808	4
DMU_14	0,823	2	0,836	8	0,991	2
DMU_15	0,651	9	0,783	10	0,683	9
DMU_16	0,744	4	0,794	9	0,668	10
average	0,690		0,827		0,725	
minimum	0,536		0,686		0,536	
average inefficiency	0,670		0,815		0,706	
effective DMU	1		1		1	
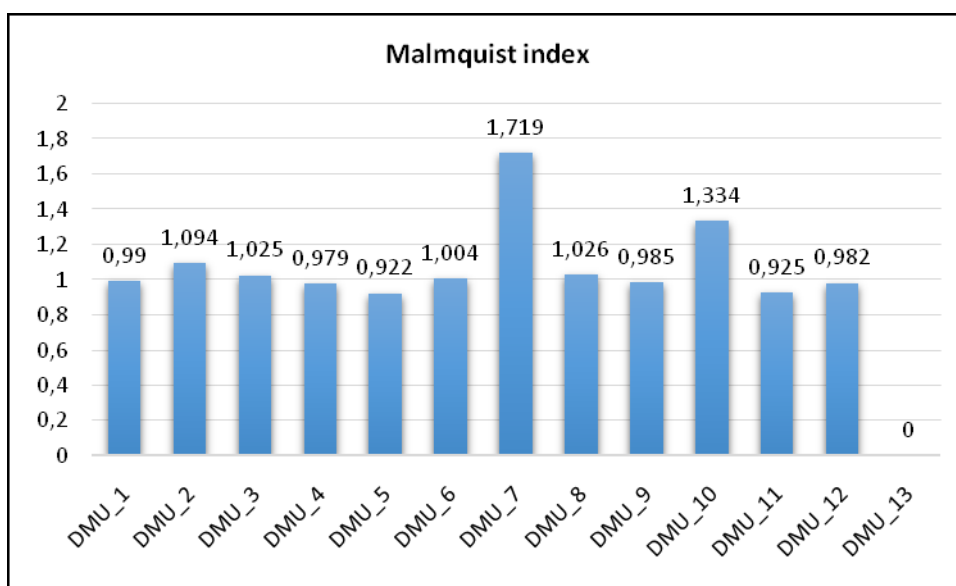
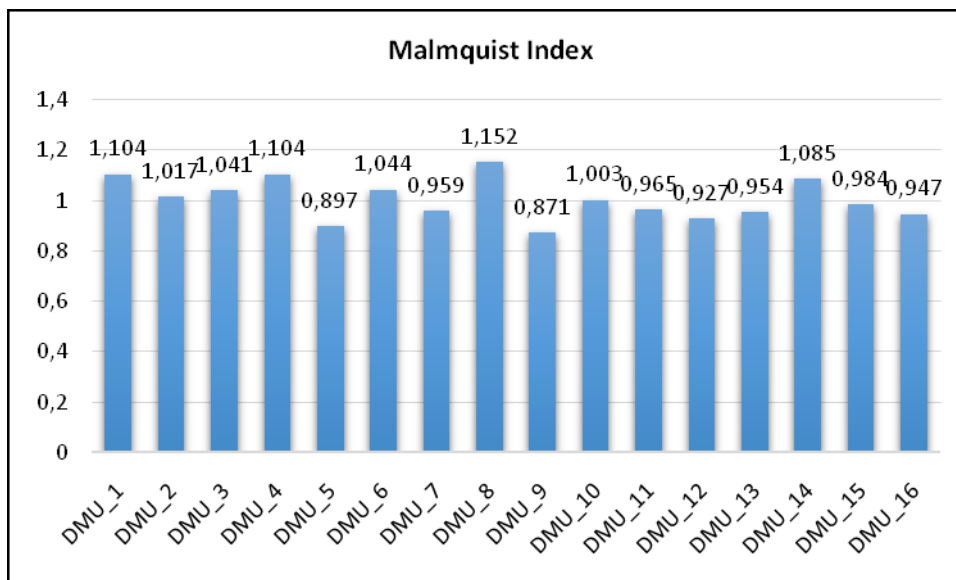Figure 3. Malmquist index value for a model no. 1 variant I

Figure 5. Malmquist index values for a model no. 2 variant I

Average value of a Malmquist index, measured on the basis of a model no. 2 variant I, is 1,003 which means that in case of a territorial division of a country average efficiency of provinces increased in researched period of time – see Figure 2. The spread of a range of observed values of Malmquist index in a subject analysis was from 0,871 to 1,152 – at the same time an convergent level of efficiency in particular provinces was observed.

Presented results from conducted measurement of efficiency regarding people with disabilities show that there is space that can be improved, in particular with reference to results obtained in models that take account

of gradation due to types of schools. Another step, especially for the Ministry of Science and Higher Education, is to analyse in details all the difficulties that disabled students encounter in given types of academic institutions and to eliminate them.

Conclusion

Communisation, inclusion of people with disabilities takes place through effective education. Conducted analyses show that a level of efficiency of researched process is less differentiated due to a territorial division (results between provinces show lower variable factor) than in classification regarding types of schools of higher education. In this area efficiency results should be improved. What is more, efficiency improvement is necessary – it is about the welfare because people with disabilities have the same rights as others. At the same time disabled people, fully educated, can find a better paid job and then they are more independent which means that there is less net spending from a state budget. It is worth remembering that rising efficiency of education according to accepted models will be possible when there are more graduates, and more importantly, it requires an individual attitude towards a particular person by identifying his/her difficulties and mutual decision about solutions. Only this attitude and appropriate system background will allow for an increase of efficiency level of educating people with disabilities.

Appendix

Table A1

Decision making units according to types of schools

Types of school	DMU_type
Universities	DMU_1
Technical higher schools	DMU_2
Agriculture higher schools	DMU_3
Economic higher schools	DMU_4
Pedagogical higher school	DMU_5
Medical universities	DMU_6
Maritime higher schools	DMU_7
University School of Physical Education	DMU_8
Artistic higher schools	DMU_9
Theological higher schools	DMU_10
Remaining schools	DMU_11
War Studies Universities	DMU_12
Universities of Interior and Administration	DMU_13

Table A2

Decision making units according to provinces

According to divisions	DMU
Dolnośląskie	DMU_1
Kujawsko–pomorskie	DMU_2
Lubelskie	DMU_3
Lubuskie	DMU_4
Łódzkie	DMU_5
Małopolskie	DMU_6
Mazowieckie	DMU_7
Opolskie	DMU_8
Podkarpackie	DMU_9
Podlaskie	DMU_10
Pomorskie	DMU_11
Śląskie	DMU_12
Świętokrzyskie	DMU_13
Warmińsko–mazurskie	DMU_14
Wielkopolskie	DMU_15
Zachodniopomorskie	DMU_16

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