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THE DATA ENVELOPMENT ANALYSIS METHOD IN BENCHMARKING OF TECHNOLOGICAL INCUBATORS

This paper presents an original concept for the application of Data Envelopment Analysis (DEA) in benchmarking processes within innovation and entrepreneurship centers based on the example of technological incubators. Applying the DEA method, it is possible to order analyzed objects, on the basis of explicitly defined relative efficiency, by compiling a rating list and rating classes. Establishing standards and indicating "clearances" allows the studied objects – innovation and entrepreneurship centers – to select a way of developing effectively, as well as preserving their individuality and a unique way of acting with the account of local needs.

Key words: *benchmarking, the Data Envelopment Analysis method, assemblage ordering, rating classes*

1. Introduction

In the contemporary world, a countries' economic growth occurs due to the implementation of innovations and modern technologies. It becomes possible to manufacture state-of-the-art products at a particular period of time. An advanced level of technology is connected with scientific research, and resultant discoveries, inventions and patents. An appropriately high absorption capacity of an economy is a sine qua non for using the results of scientific research.

In recent years, increasing the absorption capacity of the economy has been supported by the activities of various innovation and entrepreneurship centers which are business organizations. Their fundamental task is to create conditions for innovative product manufacturing, which requires entrepreneurial attitudes oriented towards applying the results of scientific research. The following types of centers linked with innovation and entrepreneurship can be found in Poland:

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- entrepreneurship Incubators,
- technological Incubators,
- academic Entrepreneurship Incubators,
- technological Parks,
- technology Transfer Centers,
- consultancy and Training Centers.

The performance of these centers, as well as other business organizations within a market economy, is subject to customer evaluation. Hence, the necessity of providing appropriate quality services, which can be supported by the benchmarking process. The application of benchmarking is fully justified, due to the fact that the innovation and entrepreneurship centers in Poland have not been functioning long enough to establish appropriate standards. In addition, successful experiences with benchmarking initiatives in similar organizations in other countries encourage its implementation.

2. The essence of benchmarking

Benchmarking is part of the concept of quality management. It is a process, a method of analyzing and comparing practices and experiences in various areas of an organizations' operations. The definitions of benchmarking in the literature on the subject emphasize the complexity of benchmarking issues and its uniqueness in different areas of application. KARLÖF and ÖSTBLOM perceive benchmarking as a continuous, systematic process based on confronting (comparing) one's own efficiency measured by productivity, quality and experience with the results of organizations which could be considered as models of excellence [1]. The definition by PIESKE is universal and applicable to various benchmarking enterprises, He defines benchmarking as a method of searching for standard manners of conduct, enabling the achievement of the best possible results by learning from others and using their experience [2]. This definition emphasizes the most important and essential element of benchmarking, i.e. learning.

From this definition, it appears that the essence of benchmarking is, above all, the identification of best practices and their creative adaptation, which excludes the possibility of ordinary copying. It is vital to maintain the continuity of the process.

The direct aims of benchmarking are: better identification of processes, comparison to others, the identification of weaknesses and strengths with respect to standards, learning how to develop management skills, overcoming aversion to ideas arising outside the organization, increasing the satisfaction of customers (to whom the organization renders services) and gaining a competitive advantage.

The types of benchmarking used result from its goals. With respect to subjective criteria we can differentiate between internal benchmarking (within the organization) and external (including competitive, within-industry and inter-industry) benchmarking. Internal benchmarking is applied in large organizations with a complex organizational structure. External benchmarking means comparing an organization to others, competitive benchmarking relies on the comparison of one's own productivity to the direct competition, within-industry benchmarking – to companies involved in the same line of business, while in inter-industry benchmarking comparison is conducted regardless of the type of business activities companies deal with. Taking into consideration the subject of benchmarking, we can distinguish the following: benchmarking of results, processes, strategy and organization. The benchmarking of results deals with the comparison of an organization's performance, e.g. its market share, and the efficiency of customer service. Such a comparison should be preliminary to further analysis determining the way of attaining the results achieved by the market leader. Process benchmarking is the most commonly applied type of benchmarking. The processes and procedures followed by an organization are subject to comparison. Strategic benchmarking involves comparing activities at the strategic level – supports the maintenance of a permanent competitive advantage by providing strategic knowledge. Organizational benchmarking is applied in processes of reorganization and improvement within the organization.

Thus benchmarking can be applied within an organization by drawing conclusions from one's own success, borrowing good ideas and selecting and applying in an innovative way the best practices implemented in other organizations. It is possible to refer widely to the standards of domestic and world leaders.

Several benchmarking paradigms must be taken into consideration before exercising benchmarking initiatives. Firstly, benchmarking is one of the fundamental tools of organizations which are in the process of acquiring knowledge, as it encourages people to observe and learn from one another. Secondly, as a process of learning from others it requires considerable "modesty", as first of all you have to acknowledge that others are better in a particular field. Thirdly, benchmarking does not mean uncritical emulation, which can be very risky if an organization does not understand its own individual constraints. Fourthly, benchmarking cannot be reduced to comparing or ranking (false benchmarking). Fifthly, the barriers to applying benchmarking remain within the organization itself.

3. The methodology of benchmarking

Studies present various methodologies describing the course of benchmarking. The application of a particular methodology depends on the specificity of a given benchmarking task. The methodology of ANDERS is universal, easy to adapt to the needs of an individual project [3]. It involves five phases of project realization: planning, searching, observation, analysis and adaptation.

Planning, which is the first stage, is very important because it decides on the success of the entire enterprise. It is a time-consuming process. According to Anders, planning has four stages. The first is the selection of the process to be subject to benchmarking. Next, a benchmarking group must be constituted, the selected process must be comprehended and substantiated and a measure of its efficiency must be determined.

The second phase – searching – involves the identification of benchmarking partners. In this phase, criteria which the benchmarking partner should satisfy are defined. It is then necessary to identify potential partners and select the most appropriate ones for the given benchmarking task.

The third phase – observation – aims at acquiring information vital to the analytical demands of benchmarking. It is necessary to learn about the processes occurring within the partner organizations and their effects. The observation phase involves formulating questionnaires, obtaining data from the partners, describing, checking and verifying the data acquired. During the realization of these tasks, it is important to pay special attention to the accuracy of the data acquired.

The fourth phase of realizing the benchmarking process – analysis – involves the standardization of data, the identification of differences between the efficiency indices for the realization of the process in the individual partners and the identifying the origin of these differences.

The aim of the last phase of benchmarking, the so-called adaptation phase, is the preparation of a plan for realizing the enterprise, followed by the implementation of this plan, together with monitoring and reporting progress. The report not only describes the actions to be undertaken, but also contains a set of recommendations for future benchmarking activities.

It is worth mentioning that the efficiency of benchmarking enterprises depends to a large extent on the continuity and regularity of the benchmarking process. Benchmarking activities should not be one-off actions. It is advisable to include benchmarking in a set of constantly applied management tools.

4. The DEA method as a benchmarking tool

Data Envelopment Analysis (DEA) can be used to determine the efficiency of objects participating in the benchmarking process [4]–[9]. By an object, we understand an organization, business, action or process. The DEA method enables establishing an order (compiling a rating list) according to the efficiency values calculated on the basis of relations within the objects, between the input signals ($x_{i,j}$), the input (causes, outlays, utilized reserves, etc.) and output signals ($y_{r,j}$), or the output (effects, results etc.). The efficiency of an object is a function of weight multipliers μ and ν.

$$e = \frac{\sum_{r=1}^{s} \mu_r y_r}{\sum_{i=1}^{m} v_i x_i}, \tag{1}$$

where:

x – input signals,

m – number of input signals,

y – output signals,

s – number of output signals.

Analysis based on the DEA method indicates the object with the largest efficiency (the highest position on the rating list), and then it compares the other objects with 'the best' one using the (Θ) measure, called the relative efficiency. Thus, any objects with the highest efficiency have a relative efficiency equal to 1, whereas the relative efficiencies of the other objects take values from the interval <0, 1>. The objects with a relative efficiency of 1 are called efficient, whereas the others are inefficient. In its traditional form, the application of the DEA method requires determination of the input and output signals. This is sometimes difficult to do when the specificity of the objects does not indicate the input and output signals in a natural way. In this case, it is possible to apply the DEA method in a modified form, where identical pre-arranged input signals are used. This is tantamount to evaluating efficiency solely on the basis of output signals, i.e. the results of the actions of the objects which constitute models of the operating organizations.

Because DEA is a non-parametric method, it is not necessary to know the functional dependencies between the input and output signals of the objects. The values of the weight coefficients for each object are determined in the optimization process. Therefore, there is no need to ascribe coefficient values in a subjective way, which is often the case using other methods.

The application of the DEA method reduces to solving a set of linear programming problems. Assuming the input signal is uniform (without loss of generality we can assume its value is equal to 1), we obtain a solution for each object Φ from an assemblage of *n* optimization problems in which the minimum value Θ_Φ is defined to be the relative efficiency measure of the process.

$$\theta_\phi \to \min \tag{2}$$

satisfying the conditions:

$$\sum_{j=1}^{n} \lambda_j \le \theta_\phi, \tag{3}$$

$$\sum_{j=1}^{n} y_{r,i}\lambda_j \geq y_{r,\phi} \quad \text{for} \quad r = 1, ..., s\,, \tag{4}$$

$$\lambda_j \geq 0 \quad \text{for} \quad j = 1, ..., n \tag{5}$$

where λ_j are the weight coefficients (linear combinations of coefficients).

The Θ_Φ coefficient, the efficiency measure, indicates how an inefficient Φ object may be transformed into an efficient object by a proportional increase in all the input signals.

$$(y_{r,\phi})_{\text{efficient}} = \frac{1}{\theta_\phi}(y_{r,\phi})_{\text{inefficient}}\,, \tag{6}$$

$$\text{for} \quad r = 1, ..., s\,.$$

Other, disproportionate changes in the input signals which make the object efficient are also possible.

The DEA method directly indicates patterns for each inefficient object. They can be treated as standards in the benchmarking process. Efficient objects for which the linear combination coefficients λ_j differ from 0 are patterns for the Φ_j inefficient object from an assemblage of objects, $j = 1, ..., n$. The value of λ_j determines the degree of similarity to the standard, i.e. the efficient object. Of course, this similarity is in accordance with the DEA algorithm, where the value of the λ_j coefficient indicates what fraction of signals of the efficient j object is contained within the inefficient object.

In general, the relative efficiency of an object depends on the input signals affiliated to it (here constant input signals were assumed). However, in certain cases an alteration of these signals does not generate any change in efficiency. Acceptable signal changes are determined by the so-called clearances (or remains) and for the Φ object they are determined in the following way:

$$\delta y_{r,\phi} = \frac{\sum_{j=1}^{n} y_{r,i}\lambda_j - y_{r,\phi}}{1 - \lambda_j}\,, \tag{7}$$

$$\text{for} \quad r = 1, ..., s\,.$$

The DEA method also enables the determination of so-called rating classes. Efficient objects (with coefficient $\Theta = 1$) belong to the first ranking class. The objects which were rejected during the selection of the first rating class belong to lower rating classes. These rating classes can be generated following the same pattern.

The division into rating classes indicates local standards (within each class), i.e. close to the studied object, which enables gradually approaching successively better objects in the benchmarking process.

The ordering of assemblages can be represented in graphic form by a Hasse diagram. This is a digraph, in which the vertexes are ascribed to the ordered objects, whereas the edges indicate relations between the objects. In the case of DEA analysis, the ordering relation represented by the set of relative efficiency values and for the objects (O_i, O_j) is:

$$O_i > O_j \quad \text{if} \quad \theta_i > \theta_j \, .$$

The procedure for compiling rating classes should be included in the diagram structure, which requires repeated determination of the relative efficiency.

5. DEA analysis in the process of benchmarking technological incubators

The technological incubators (TI) selected for further analysis were from a group of six types of innovation and entrepreneurship centers. At present 21 TI, of which 19 are technically operating, are active in Poland (table 1). Others are in the process of forming or opening, or their operation has been suspended.

Table 1

No.	Code	Name	Managing Institution	City/Town
1	2	3	4	5
1	A	Inkubator technologiczny	Bełchatowsko-Kleszczowski PPT	Bełchatów
2	B	Inkubator Technologiczny	Stowarzyszenie Inicjatyw Społeczno-Gospodarczych	Białogard
3	C	Beskidzki Inkubator Technologiczny	Agencja Rozwoju Regionalnego	Bielsko
4	D	Elbląski Inkubator Nowoczesnych Technologii Informatycznych	UM Elbląga	Elbląg
5	E	Pomorski Inkubator Innowacji i Przedsiębiorczości	Gdyńskie Centrum Innowacji	Gdynia
6	F	Inkubator technologiczny	Fundacja Kaliski Inkubator Przedsiębiorczości	Kalisz
7	G	Rybnicki Inkubator Technologiczny	Górnośląska Agencja Przekształceń Przedsiębiorstw S.A.	Katowice
8	H	Krośnieński Inkubator Technologiczne "Krintech" Sp.z o.o.	Krosno	Krosno
9	I	Inkubator Technologii i Przedsięwzięć Innowacyjnych	Akcelerator Technologii UŁ	Łódź
10	J	Inkubator technologiczny ARTERION	Fundacja Wspierania Przedsiębiorczości i Nauki	Łódź

Table 1 continued

1	2	3	4	5
11	K	Łódzki Inkubator technologiczny	Łódzki Regionalny PN-T Sp.z o.o.	Łódź
12	L	Inkubator Przedsiębiorczości IN-MARR	ARR MARR S.A.	Mielec
13	M	Inkubator technologiczny	Fundacja Uniwersytetu im. A. Mickiewicza w Poznaniu – Poznański Park N-T	Poznań
14	N	Inkubator technologiczny	Park Naukowo-Technologiczny Polska-Wschód	Suwałki
15	O	Szczecińskie Centrum Przedsiębiorczości	Zachodniopomorskie Stowarzyszenie Rozwoju Gospodarczego – Szczecińskie Centrum Przedsiębiorczości	Szczecin
16	P	Inkubator Przedsiębiorczości	Szczeciński Park Naukowo-Technologiczny	Szczecin
17	R	Inkubator technologiczny	Techno-Port Warszawa – Inkubator Technologii	Warszawa
18	S	Centrum Rozwoju Przedsiębiorczości	Politechnika Warszawska	Warszawa
19	T	Dolnośląski Inkubator Naukowo-Technologiczny Inkubator-Centrum Technologii	Wrocławski Park Technologiczny	Wrocław

Source: based on [10] and the author's own research.

The data used to analyse these technological incubators were obtained from the report: "Ośrodki innowacji i przedsiębiorczości w Polsce" (*Centers of Innovation and Entrepreneurship in Poland*) [10] and the author's own research. Taking into consideration the main aim of an incubator's operation, which is to support businesses and develop an innovative environment, the following data were selected to be input signals in the object model for the DEA analysis:

- The number of companies operating within the incubator – the input signal y_1,
- The number of people employed by these companies – the input signal y_2,
- The area occupied by these companies – the input signal y_3,
- The number of activities in the field of environmental protection (consultancy, training, financial aid) – the input signal y_4.

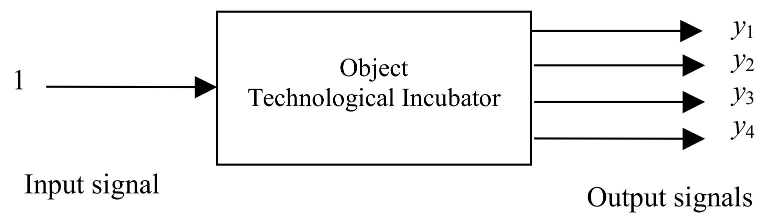

Fig. 1. Model of object in the DEA analysis
Source: the author

A constant input signal equal to 1 was assumed in the models of all the objects. Thus the model for DEA analysis is an object with one determined input signal and four output signals (figure 1).

The values of the output signals are shown in table 2, in columns 3–6. The individual objects, described in table 1, are denoted by letter codes from A to T (column 2). The relative efficiency Θ_1 (column 7) was determined by solving the optimization problems (19 problems) defined for the studied group of 19 objects. A relative efficiency of 1 was ascribed to two objects – object "I" and object "T" and these two objects constitute the first rating class (column 11). This procedure was repeated for the group of 17 objects remaining after removing objects "I" and "T". Four objects – "F", "G", "J", "O", which constitute the second rating class (columns 8, 12), have a relative efficiency equal to 1 based on these 17 objects. By repeating this procedure, the subsequent ranking classes (table 2 – columns 9, 10, 13, 14, 15) were defined.

Table 2

No.	Code	y_1	y_2	y_3	y_4	Θ_1	Θ_2	Θ_3	Θ_4	Kl-1	Kl-2	Kl-3	Kl-4	Kl-5
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	A	10	47	1100	13	0.708	0.759	0.857	1				A	
2	B	7	52	4942	1	0.549	0.727	1				B		
3	C	30	150	1800	3	0.508	0.591	0.844	1				C	
4	D	17	48	390	10	0.567	0.644	0.736	0.916					D
5	E	17	61	700	12	0.665	0.751	0.846	1				E	
6	F	23	302	3847	12	0.751	1				F			
7	G	51	348	2982	10	0.864	1				G			
8	H	5	25	1200	10	0.553	0.592	0.677	0.945					H
9	I	15	36	120	19	1				I				
10	J	6	22	185	18	0.949	1				J			
11	K	9	23	281	13	0.689	0.752	0.814	1				K	
12	L	20	135	3856	13	0.773	0.853	1				L		
13	M	36	202	2082	11	0.701	0.852	1				M		
14	N	14	57	361	7	0.406	0.464	0.538	0.703					N
15	O	39	220	6800	14	0.896	1				O			
16	P	17	44	520	5	0.321	0.395	0.472	0.706					P
17	R	11	40	310	16	0.847	0.926	1				R		
18	S	4	8	240	4	0.216	0.239	0.266	0.317					S
19	T	59	519	9000	15	1				T				

Source: the author.

The results of these calculations are presented in the following figures. The affiliation of objects to successive rating classes is indicated.

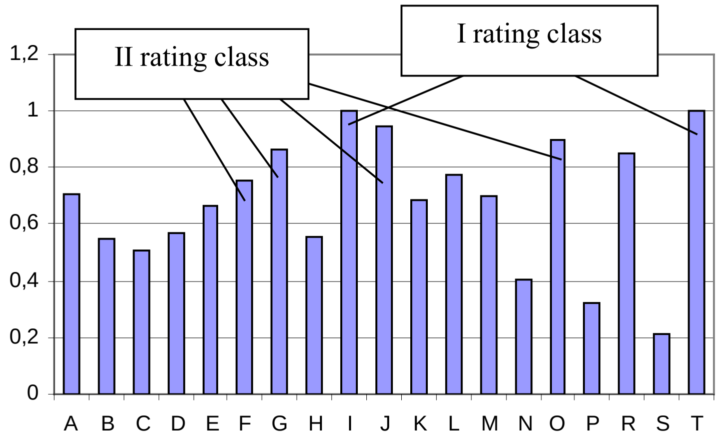

Fig. 2. Relative efficiency Θ_1 in the group of 19 objects
Source: the author

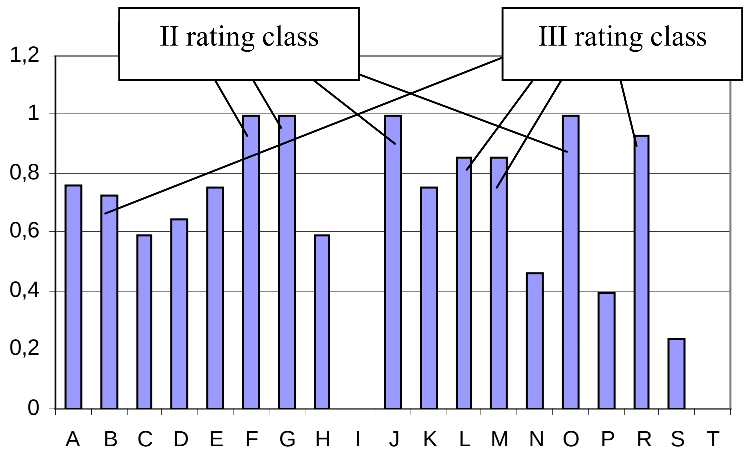

Fig. 3. Relative efficiency Θ_2 in the group of 17 objects not in class I.
Source: the author

The results presented show that the order (rating) in a subgroup of objects cannot be inferred from the order in the original group. For example, in the group of all objects (the original group – 19 objects) object "R" occupied a higher position than object "F" (figure 2). However, in the first subgroup (after removing the two objects with the highest rank) object "R" followed object "F" (figure 3). This is a characteristic of multidimensional analysis in determining a so-called partial order, in contrast to one-dimensional analysis and linear orderings.

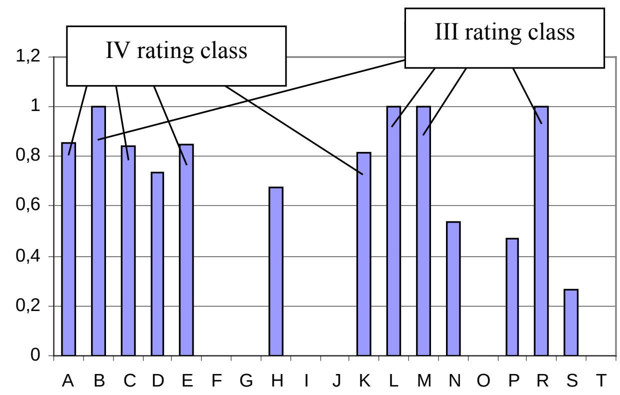

Fig. 4. Relative efficiency Θ_3 in the group of 13 objects not in class I or II.
Source: the author

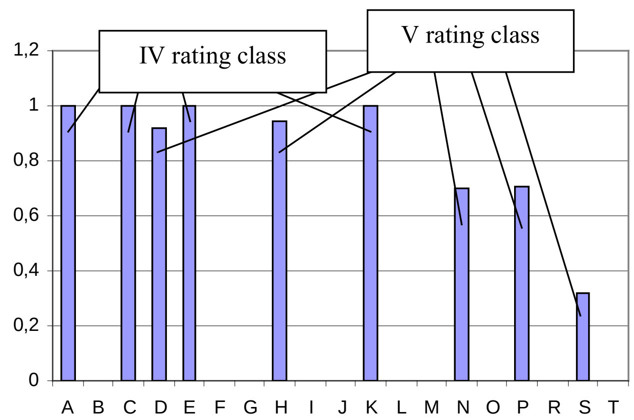

Fig. 5. Relative efficiency Θ_4 in the group of 9 objects not in class I, II or III
Source: the author

Apart from determining the order and rating class divisions, DEA analysis provides a lot of information useful to the benchmarking process. The weight coefficients λ calculated by solving the optimizing problem describe the similarity between objects, while the clearances indicate the range of changes in a signal which do not result in an increase in efficiency and therefore do not lead to a change in the rank of an object.

Table 3 contains the results of calculations for objects in the 2nd rating class in relation to the 1st rating class. The values of the λ coefficient are given (columns 4, 5) and in columns 6–9 the δ_y clearance values are presented for the signals: y_1, y_2, y_3, y_4. In some cases, the clearance values are large, which is due to the large range in the data assemblage (table 2).

Table 3

No.	Code	Θ_1	λ_9	λ_{19}	clearance y_1	clearance y_2	clearance y_3	clearance y_4
1	2	3	4	5	6	7	8	9
1	A							
2	B							
3	C							
4	D							
5	E							
6	F	0.751	0.18	0.57	13		1298	
7	G	0.864		0.86		101	4798	3
8	H							
9	I	1	1					
10	J	0.949	0.94	0.01	9	16		
11	K							
12	L							
13	M							
14	N							
15	O	0.896	0.14	0.75	8	176		
16	P							
17	R							
18	S							
19	T	1		1				

Source: the author.

Table 4 presents the results of calculations for objects from the 3rd rating class with relation to the 2nd. The values of the λ coefficient are given for signals y_1, y_2, y_3, y_4 (columns 4–7) and the values of the clearance, δ_y, are presented in the subsequent columns (columns 8–11). As before, in some cases the clearance values are large, which is due to the large range of the assemblage data (table 2).

Table 4

1	2	3	4	5	6	7	8	9	10	11
No.	Code	Θ_2	λ_6	λ_7	λ_{10}	λ_{15}	clearance y_1	clearance y_2	clearance y_3	clearance y_4
1	A									
2	B	0.727				0.73	21	108		9
3	C									
4	D									
5	E									
6	F	1	1							
7	G	1		1						
8	H									
9	I									
10	J	1			1					

Table 4 continued

1	2	3	4	5	6	7	8	9	10	11
11	K									
12	L	0.853	0.03		0.28	0.54	4			
13	M	0.852		0.23		0.62		15	2827	
14	N									
15	O	1				1				
16	P									
17	R	0.926			0.76	0.17		13	953	
18	S									
19	T									

Source: the author.

Table 5 presents the results of calculations for objects from the 4th rating class with relation to the 3rd. The values of the λ coefficient are given for signals y_1, y_2, y_3, y_4 (columns 4–7) and the values of the clearance, δ_y, are presented in the subsequent columns (columns 8–11). As before, in some cases the clearance values are large, which is due to the large range of the assemblage data (table 2).

Table 5

No.	Code	Θ_3	λ_2	λ_{12}	λ_{13}	λ_{17}	clearance y_1	clearance y_2	clearance y_3	clearance y_4
1	2	3	4	5	6	7	8	9	10	11
1	A	0.857		0.24		0.62	2	10		
2	B	1	1							
3	C	0.844		0.02	0.82			19		6
4	D									
5	E	0.846			0.31	0.54		23	108	
6	F									
7	G									
8	H									
9	I									
10	J									
11	K	0.814		0.01		0.81	0	10		
12	L	1		1						
13	M	1			1					
14	N									
15	O									
16	P									
17	R	1				1				
18	S									
19	T									

Source: the author.

Table 6 presents the results of calculations for objects from the 5th rating class with relation to the 4th. The values of the λ coefficient are given for signals y_1, y_2, y_3, y_4 (columns 4–7) and the values of the clearance, δ_y, are presented in the subsequent columns (columns 8–11). As before, in some cases the clearance values are large, which is due to the large range of the assemblage data (table 2).

Table 6

1	2	3	4	5	6	7	8	9	10	11
No.	Code	Θ_4	λ_1	λ_3	λ_5	λ_{11}	clearance y_1	clearance y_2	clearance y_3	clearance y_4
1	A	1	1							
2	B									
3	C	1		1						
4	D	0.916		0.11	0.81			18	372	
5	E	1			1					
6	F									
7	G									
8	H	0.945	0.72	0.23			9	43		
9	I									
10	J									
11	K	1				1				
12	L									
13	M									
14	N	0.703		0.16	0.54		0		306	
15	O									
16	P	0.706		0.39	0.32			33	397	
17	R									
18	S	0.317	0.2		0.12			9	61	
19	T									

Source: the author.

The results of the analysis are presented in graphic form using a modified form of the Hasse diagram in figure 6. The relations between objects marked in the diagram are exactly those which were indicated in the DEA optimizing procedure by λ coefficients relating objects from neighbouring rating classes.

The results of such analysis can be helpful in making decisions concerning the development of individual incubators. The affiliation to a rating class, relative efficiency Θ and coefficients λ indicate relations between incubators. Thanks to this, it is possible to determine qualitative and quantitative changes which create favourable conditions for improving the rating of an incubator. Changes that are not very efficient can be avoided using the clearance derived.

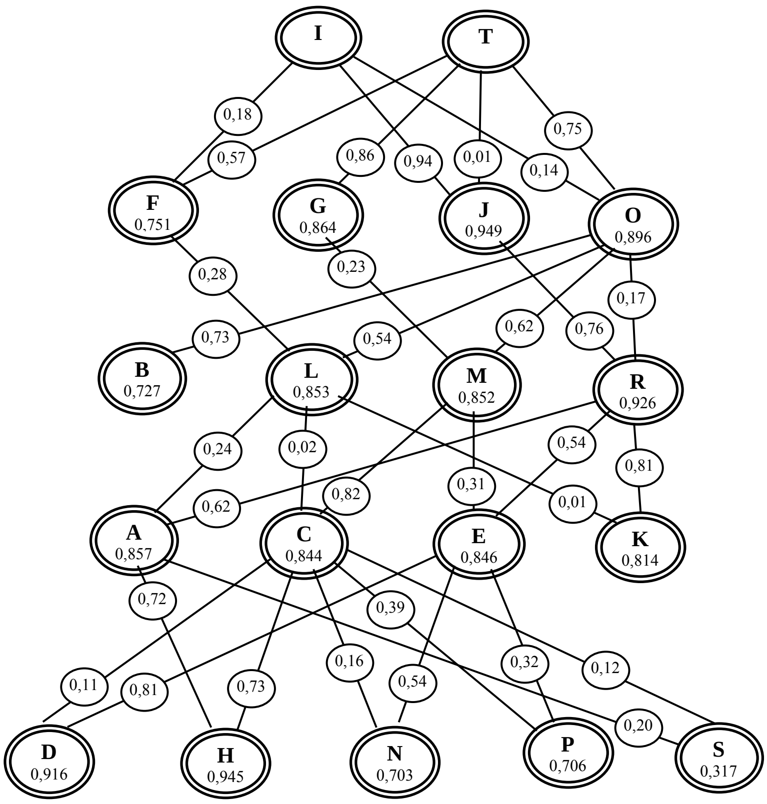

Fig. 6. Results of the analysis in the form of a Hasse diagram.
Source: the author

5. Conclusions

This modified version of the DEA method facilitates the process of benchmarking by providing data with the precision ascribed to mathematical methods. Multidimensional analysis is possible without the necessity of making subjective decisions. The following crucial benefits resulting from the application of the DEA method in the process of benchmarking can be enumerated:

• Ordering the objects analyzed (these are the organizations subject to the process of benchmarking) on the basis of an explicitly defined parameter (Θ), called the relative efficiency, and forming a rating list.

• Determining rating classes to which objects with the same rank on the rating list belong. These objects are not compared to each other, but obtain the same position on the rating list in a different way – based on various combinations of input and output signals.

• Establishing standards in relation to objects assessed to be the most efficient and determining (λ) the degree of similarity using weight coefficients. The division into rating classes makes it possible to establish distinct standards, which naturally helps to adopt beneficial solutions.

• Determining "clearances" enables selecting an effective way of developing successful solutions and avoiding not very successful solutions.

The results obtained from analysis using the DEA method support the realization of the primary task of the benchmarking process, which is indicating effective ways of development in order to improve the rank of an incubator by a unique and distinct way of operating. Development does not have to mean becoming identical to a model object, but has to take into consideration the local demands of the environment.

The results of DEA analysis depend on the choice of data. Therefore, the ranking obtained in the course of analysis and the links to other objects should only be treated as a initial guide not as a final verdict. Such research can be re-conducted taking into consideration additional factors by introducing other data, which seems to be a natural way of acting in the benchmarking process.

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