

KRISZTINA, TIBENSZKYNÉ FÓRIKA

EFFICIENCY RESEARCH OF THE HUNGARIAN MILITARY HIGHER EDUCATION PROCESS

KÍSÉRLET A MAGYAR KATONAI FELSŐOKTATÁS HATÉKONYSÁGÁNAK MÉRÉSÉRE

The actuality of this issue is derived from the lately revealed competition of universities which resulted in a more quality focused approach in teaching, which puts quality in front of quantity. The demand has arisen in relation to the Hungarian military higher education as well to achieve better results for a smaller investment. Seeping changes respect training and organizational structure at the Miklos Zrínyi National Defence University running nowadays, contribute the conservators much the largest pressure and inner proposal and the questions relating to efficiency have emerged in the institution. The examination of efficiency and the question of measurement possibilities therefore have turned out to be one of the main research directions these days. The aim of this study is to introduce efficiency measurement possibilities for military higher education with the application of the Data Envelopment Analysis (DEA) method.

A felsőoktatási intézmények között kiéleződött a verseny, és a minőség helyeződik előtérbe a mennyiségi képzéssel szemben, és az elmúlt években egyre erőteljesebben jelentek meg a társadalom elvárásai a felsőoktatással szemben. A magyar katonai felsőoktatással szemben is megfogalmazódott az az igény, hogy kevesebb ráfordítással, nagyobb eredményt érjen el. A Zrínyi Miklós Nemzetvédelmi Egyetemen zajló — a képzési folyamatot és a struktúrát egyaránt érintő — változásokhoz, a fenntartó egyre nagyobb fokú nyomása és belülről jövő kezdeményezések is hozzájárultak, és az intézmény működésében előtérbe kerültek a hatékonysággal kapcsolatos kérdések. A hatékonyság vizsgálata és mérési lehetőségeinek kérdése így napjaink egyik fő kutatási irányvonalává vált. A tanulmány célja, hogy bemutassam a katonai felsőoktatás hatékonyságának mérési lehetőségeit a Data Envelopment Analysis (DEA) módszer alkalmazásával.

Seeping changes respect training and organizational structure at the Miklos Zrínyi National Defence University running nowadays, contribute the conservators much the largest pressure and inner proposal. The demand has arisen in relation to the military higher education as well to

achieve better results for a smaller investment. The meaning of such fashionable expressions as „increasing the efficiency of the education” carry an entirely different meaning from an economics point of view

Efficiency is „...the relationship between the products, services and other results created during a given activity and the resources used for their creation.” In economics this relationship is described by the ratio of the resources employed and the products or services produced [1]. Efficiency therefore provides information concerning the relation between the products, services created during the operation of the organisation and the resources exploited for the creation of these.

Performance and efficiency are often used as synonymous terms; however, efficiency is a part of performance. Efficiency cannot be calculated without a point of comparison: we can only say that an organisation is effective „in relation to something else” [2]. With the aid of efficiency examination we are able to establish that in an optimal situation how the inputs are to be applied in order to make sure that the outputs correspond with the requirements.

THE MEASUREMENT OF EFFICIENCY

In econometrics the theories derived from the production function serve as the basis for the establishment of scale efficiency¹, Scope² effectiveness, allocative efficiency³, technical efficiency⁴. If we assume that the production process is directed towards the release of one

type of product, the curve enveloping the production set from above is the production function (e.g. manufacturing) whose variables are the resources (e.g. money, work, spare parts), while its value is equal to the output (e.g. end product).

From the production function a desired state (e.g. maximum output, minimum cost) can be estimated using various methods. The method of least squares minimizes the square amount of the difference between the

¹ The economic operational size can be defined as the quotient of the average cost and the marginal cost.

² A company is scope-effective if they conclude cost saving from the production of two products inside one organization as opposed to the separate, two-unit solution.

³ The optimum structure of resources applied.

⁴ The establishment of the method of the utilization of input combinations.

real and the estimated values; regression analysis approximates the target state applying the methods of statistics, based on trials, while stochastic frontier analysis does the same using the methods of probability calculus. The methods can work well in economic processes; however, in higher education neither the production function (training), nor the applied resources (e.g. lecturer, student), nor the output (e.g. graduates) can be easily determined.

The situation is even more complicated due to the fact that higher education creates multiple outputs (e.g. graduates, conferences) from multiple inputs (e.g. contact lessons, students, researches).

The non-definability of the production function as well as the incompleteness of the prices of multiple input and output data require a different approach. The new approach is linked to Charnes, Cooper and Rhodes [3] who, instead of using the production function as a starting point, they applied the actual performance of the individual organisations (decision-making units). The method abandons the intention to calculate the absolute efficiency indicators of the organisations. By comparing the data of the individual units it generates an optimum efficiency threshold, and the distance from this provides the extent of smaller efficiency.

The comparison results in a delimiter that kind of envelopes the most effective units. In order to get to this efficiency level for an organisation, it has to modify the composition of its resources. In order to provide a theoretical basis for the demonstration of the examination, let us examine an imaginary database consisting students studying at two different departments. At the end of the studies, both departments release students with different diploma results.

The diploma result and the mark received at the final examination form the output data of the student treated as an individual decision making unit, while the number of points for acceptance, the ratio of the individual learning working hours and the contact hours form the input data (figure 1.)

The level lines of the education process can be displayed in a frame of reference, for the points of these the same input — in this case entrance exam points, individual working hours and contact lesson ratio — is required. The $G_0G_1G_2G$ line represents the maximum performance for students at department G that has been achieved by some students studying at the same department [4].

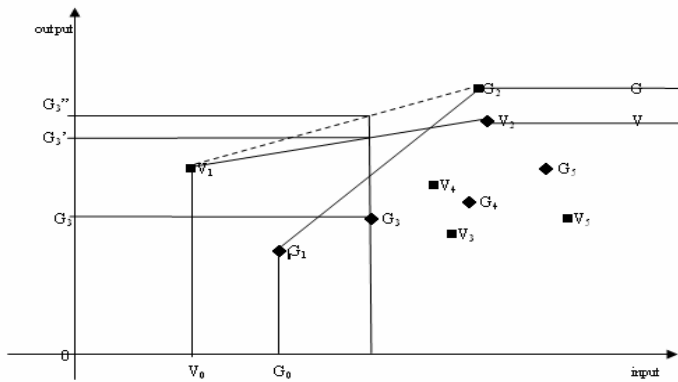


figure 1. ◆ Dept. G ■ Dept. V

When we calculate the VRS efficiency of a unit, we can tell how much the unit should increase the outputs in order to be on the efficiency limit compared to the efficiency of the other units. Student G_3 has not proved to be effective as he is not on the $G_0G_1G_2G$ isoquant, at the same time the OG_3/OG_3' ratio shows how the student can reach better results at the given department.

The performance limit of students at department "V" is represented by the line $V_0V_1V_2V$, at the same time, if we examine the two departments together, this limit will be $V_0V_1G_2G$. Although Student B proved to be efficient at his own department, examining the entire system, he is not that anymore.

For Student G_3 the goal can be twofold: if he wishes to improve his results at his own department he must consider the OG_3/OG_3' ratio, while if he wishes to satisfy the higher demands of the entire system, he should consider the OG_3''/OG_3' ratio.

The practical application of the theory takes place via the so-called Data Envelopment Analysis (DEA) process that, on the one hand, provides the efficiency indicators of the examined decision units (technical efficiency, size efficiency), on the other hand it provides an alternative concerning the optimum composition of the resources, with which the organisation can improve efficiency.

The method enables the measurement of education and training activities, the comparative analysis of the efficiency of higher education institutions and the preparation of system-level efficiency analyses.

THE RESULTS OF THE EXAMINATION CONDUCTED AT THE UNIVERSITY OF NATIONAL DEFENCE

The application of the Data Envelopment Analysis (DEA) for 559 students obtaining diplomas in 2006 at the Miklós Zrínyi National Defence University (ZMNE) took place with the goal to introduce a possibility for the measurement of the education efficiency at the university using a method based on operation research foundations, at the same time using a process supported by informatics.

During the individual-level analysis we can receive answers to questions such as whether the negative or positive performance of the student can be attributed to the own efforts of the individual or to the exploitation of resources in a given state. The examination can also be stimulating for the individual departments in order to select the strategy they can increase the quality of their education with. I have prepared altogether 16 DEA efficiency analyses on various data with the aid of version 2.1 of the DEAP program prepared by Coelli T.J. [5]

The efficiency results of the students compared to their own department and the entire university differed from each other. In the analysis conducted on the unified database the efficiency results are normally worse, apart from the military management department, where they are better. This shows that these have been students in this department who did not prove to be successful in their own department, but they were compared to the entire university. This means that a student who was admitted with a relatively low number of points could still achieve a „good” or „excellent” result, which reflects the positive influence of the department on the increase of the efficiency of the education.

Moreover, taking into account that those who were admitted with medium abilities and finished with a medium result are entirely efficient compared to themselves, it can be concluded that it is practical to promote those students who have performed well compared to their own subject and to all other students as well. It can be considered as a control of the DEA efficiency examination that in certain subject there was no 100% efficient student at all and that the number of students finish-

ing excellent is also zero. On the correspondence course the average performance of the examined 387 people compared to the entire university is 77% that is 6 per cent less than that of the full-time students, the deviation interval of the various departments is between 73-84%. The own efficiency indicators of the mechanical engineering and the electrical engineering departments are over 90%, which means that both departments strive to get the highest possible performance out of their students. Among full-time programs the mechanical engineers, while among correspondence courses the electrical engineers were the most successful at this according to the 2006 data.

SUMMARY

With the short introduction to the theory of the DEA procedure and with the demonstration of its practical application it can be concluded that with the application of the method the measurement of efficiency becomes possible in education. The DEA procedure conducted on a database cleared of features suitable for personal identification have proven to be suitable for displaying the effects of the departments on the individuals and their influence to the diploma results. Apart from all, with the aid of the results of the DEA method, the heads of the various departments can obtain information on whether they need to encourage the students or the teaching staff of their own departments in order to increase the efficiency of the learning-teaching process. Furthermore the process provides a possibility for the managers to make decisions on the various strategies in order to increase the learning efficiency of the individuals.

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