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WAYS TO IMPROVE THE BUDGET SUPPORT OF SCHOOL EDUCATION DEVELOPMENT IN UKRAINE

Abstract. *The efficiency of budgetary funding for general secondary education is a quite relevant issue, as such funding requires a significant proportion of budget resources spent on education. International researchers have suggested different approaches to determining this efficiency. The article examines if it's possible to use one of the modifications of the Data envelopment analysis (DEA) method to assess the efficiency of budget financing of general secondary education. This method was tested on the data on the financing of schools in the Zaporizhzhia region of Ukraine in 2020 using resources from four types of local communities budgets (regional budget, city budget, district budget and the LC budget). The resulting indicators of the model (outputs of funding) have been constructed based on the results of the nationwide external independent assessment in several subjects, which the students obtained after graduation. The authors offered several variants of the resulting indicator and calculated the integrated efficiency indicator. It is shown that it is partly possible to solve the problems of optimization of the network of secondary education institutions by the simulation approach using DEA. The quality of education is generally lower in small general secondary education institutions, as such they need to be reorganized. At the same time, other school activity indicators that may not be reflected in education statistics need to be taken into account when making final management decisions to optimize the school network, in addition to the results of a nationwide independent external evaluation. In particular, economic and social factors should be further considered, such as the possibility of economic development of the settlement at the expense of local resources, infrastructure, proximity to markets, energy factors, etc. In this case, the methods of economic and mathematical simulation are applicable.*

Keywords: *budget education expenditures, data envelopment analysis (DEA) method, efficiency indicators, optimization of the school network.*

JEL classification: H52, I22, I28.

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Introduction. Human capital is becoming an increasingly important factor in the functioning of modern national economies, especially those oriented towards new technologies and innovation. The scientific approach has evolved in interpreting the meaning of human capital from an initial, predominantly physical [1] interpretation to a more comprehensive understanding that stresses the importance of intelligence-related personality traits. This is also reflected in the further development of economic growth theory, which emphasizes that through learning, skills development and education, people become more productive and innovate new technological processes. As a result, the country's economy is greatly accelerated [2; 3].

One of the most common and actual definitions of human capital is that of the Organization for Economic Cooperation and Development [4; 5], which states that «it is the knowledge, skills, competencies and attributes embodied in the individual that contributes to personal, social and economic well-being». The main components of human capital are the factors of a person's health and education, which are required by any labor market [6–8]. In this regard, scholars highlight the importance of public investment in education, as it ensures the sustainable economic development of society, the preservation of cultural interaction and the intergenerational transfer of experience [9; 10].

An original study of the impact of education on life expectancy regardless of its impact through income growth was carried out by Wigley and Akkoyunlu [11]. An empirical study showed, among other things, that a 1 % increase in per capita income increases life expectancy by 0,073,954 %. Thus, the channels through which education influences the health system that provides life expectancy were statistically investigated, and therefore a broader approach to human capital research was suggested. A group of researchers [12] explored the concept of human capital by which authors understand the resources associated with the knowledge and skills of individuals and consider it an essential component of economic development. Comparing the trends of schooling and learning the researchers prove that they are not the same. In addition, this paper presented a database of globally comparable learning outcomes (Harmonized Learning Outcomes) for 164 countries, covering 98 % of the world's population from 2000 to 2017. This database allows tracking of the formation of human capital using a new human capital index of the World Bank. General secondary education plays a key role in the human learning process. It is the longest (usually from 6 to 18 years) and the most information-intensive period of learning content in a human's life when a person is formed as an individual and acquires knowledge that has been carefully selected through the experiences of previous generations, as well as learns important skills for socialization.

In European countries, there is multi-source funding for general secondary education, but the lion's share of funding comes from the budget [13]. And the issue of the efficiency of budget funding remains on the agenda because governments sought to get the best educational outcomes within reasonable budgetary educational expenses. Given the diversity of schools, which vary in the number of students, the contingent

of their teaching staff, and other characteristics of schools, it appeared to be a quite difficult task. This relates primarily to small schools in rural areas. The rural school is an important part of the public space, often the only one in small settlements. School closures can be a trigger for the rural decline, as young families often decide to leave such a village.

The purpose of this research was to examine some methodological aspects of the efficiency analysis of governmental funding of general secondary education in Ukraine using a model-based approach. First of all, it concerns indicators, data and methods that can be used for such analysis. The study was carried out on the example of the Zaporizhzhia region school network as a relatively evenly populated plain territory without specific geographical features (i.e. lack of mountainous and difficult-to-access schools, etc.).

Literature review. Researchers mainly use statistical, economics and mathematical methods to quantify the efficiency of budget expenditures on education. These methods make it possible to identify the interdependencies or discrepancies between educational outcomes and budget allocations and thus provide educational managers with a basis for developing priority actions to improve the situation.

For example, the joint study by Kovtunets and Londar [14] presents an approach to assessing the efficiency of the use of budget funds allocated to Ukrainian universities, based on a comparison of statistical and model methods. A comparison was made between the results of the «bottom-up» method of estimating the cost of university services (statistical results of university self-assessments of the budget costs for the training of specialists in particular specialties) and «top-down» (results of the regression model developed by the authors to determine average budget costs for the training of specialists in particular specialties). The obtained results showed that in Ukraine the state budget expenses for preparing bachelors of socio-economic specialties in full-time education are higher than the corresponding expenditures for preparing bachelors in technical specialties, despite the need for expensive equipment, consumables and support staff to train students in technical fields. This imbalance was found to be due to the existing system of allocation of public funds, and suggestions were made by authors to address this issue. The need to diversify the financing of the educational sphere in Ukraine, taking into account the leading international experience, is discussed in the study of Dunaieva et al. [15].

The article [16] studies the problems of public spending on education and R&D in the context of economic growth and the effectiveness of government policy. In particular, attention is focused on public funding aimed at the development of innovative technologies (R&D expenditures) and education financing as an aspect of improving the quality of human capital. The relationship between education and R&D expenditures in Central European countries was examined in the context of the overall impact on GDP.

Chocholata [17] conducted a study aimed at establishing a spatial relationship between educational performance and certain socio-economic indicators at the district level. The analysis revealed significant differences

in educational performance as well as in socio-economic indicators for the areas analysed, depending on their location.

Herczyński [18] applied statistical methods of analysis which showed that, compared to OECD countries, Macedonian allocations for general secondary education in terms of GDP per capita were insufficient. It was suggested that the indicator of efficiency may be the deviation from the OECD average, and proposals were made for a strategy to gradually increase funding for education in order to approach this average.

The work of Alonso and Sanchez [19] is devoted to the issue of the efficiency of budget financing of general secondary education in countries with transition economies. The average indicator for a number of countries in terms of GDP per person is adopted as an indicator of efficiency.

The World Bank study «Review of the Education Sector in Ukraine: Moving toward Effectiveness, Equity and Efficiency» [20] discusses the specifics of using the formula for the distribution of general secondary education funding, which has been in force in Ukraine since 2015. In 2018, this formula was changed, as a result of which an estimated standard of efficiency is used based on the geographical density of students. For those local governments where the average size of school classes is less than the estimated standard of efficiency, financial formula restrictions are imposed. As a consequence, local governments may have a surplus or deficit of the budget education subvention, depending on the ratio between the actual and desired state of the school network. It is noted that providing incentives to improve the efficiency of financial resource usage remains an urgent task.

Another method can be used to analyze the efficiency of secondary education governance at the level of the local communities. One of the promising approaches is Data envelopment analysis (DEA). It was proposed by Charnes A., Cooper W. and Rhodes E. in 1978, and initially used for the estimation of the efficiency of programs of non-profit organizations financed from public funds [21].

Since then, this method has been used in many other cases when there are several factors that characterize the costs (inputs) that can be managed and several indicators of efficiency (outputs) that indicate the management efficiency [22–24]. At the same time, some authors point out certain shortcomings of CCR models used in the DEA method. Approaches to their joint use with other models are offered [25].

Bakhrushyn [26] analyzed typical mistakes arising in the optimization of the educational institutions' network in Ukraine. In particular, it is noted that output indicators are often not used in decision-making on these issues at all, or input (resource) indicators are used as outputs (results). Therefore, «optimization» is often understood as a reduction in total expenditures, rather than as an increase in socially important results, which may be obtained under certain expenditure constraints.

Data and methodology issues. This research was designed to test the hypothesis that one of the modifications of the Data envelopment analysis (DEA) method could be used to assess the efficiency of state funding of secondary education. According to the purpose of this research, we examined the methodological aspects and data which may be used for the efficiency analysis of state funding of general secondary

education in Ukraine using a model-based approach.

The sets of data were formed from the database of the Ukrainian educational information system AICOM (Law of Ukraine «On amendments to certain laws of Ukraine on the functioning of integrated information systems in the field of education», https://zakon.rada.gov.ua/laws/show/2457-20#Text), which collects educational information according to official statistical forms at the level of each school. The official reports of the State Treasury Service of Ukraine regarding the amount of educational subvention for teachers' salaries, which were directed to each community of the Ukrainian region, were also used («Report on the provision and use by local budgets of grants and subventions received from the state budget for 2020», https://dostup.pravda.com.ua/request/zalishki_osvitnoyi_subvientsiyi_47#incomin%20g-227134.).

The data on funding of schools in the Zaporizhzhia region in 2020 were used for this research as Zaporizhzhia is a representative region of Ukraine (it is a relatively evenly populated plain area without specific geographical features, i.e. lack of mountainous and difficult-to-access schools, etc.). Thus, the study sample included the school network of 49 local communities in the Zaporizhzhia region.

As the final results of the educational process, some results of the annual nationwide independent external evaluation (EIE) were used. The EIE was introduced in Ukraine in 2008, and it is used for admission to higher education institutions and attestation of school graduates. It should be noted that the introduction of the EIE in Ukraine was supported by international organizations and contributed to the improvement of the quality of secondary and higher education, had a positive impact on the general level of education and became a significant factor in ensuring equal access to higher education and overcoming corruption. The results of the EIE are publicly available, the assessment is carried out at the national level, and the rules and tests are the same for all participants. The website of the Ukrainian Center for Education Quality Assessment (UCEQA, http://testportal.com.ua) provides complete depersonalized data on the results of all participants regarding the educational institution where they studied, as well as some generalized data in terms of schools, districts, cities, and regions of Ukraine. Therefore, the results of the EIE demonstrated by the graduates of the Zaporizhzhia region may be used as the output indicators of our model.

In this way, we analyzed the possibilities of application a model approach to evaluating the efficiency of budget funding of schools using the EIE results as a criterion of effectiveness within the method of Data envelopment analysis (DEA).

Results. Fig. 1 provides details on the relationship between the number of budget expenditures in a form of the educational subvention per student and the number of students in a class (fill rate) in terms of budget types that exist in the Zaporizhzhia region as well in each region of Ukraine. The general pattern shows that the larger the class size, the lower the budget expenditure per student.

The highest budget expenditures per student (66813 UAH) fall on general secondary education institutions

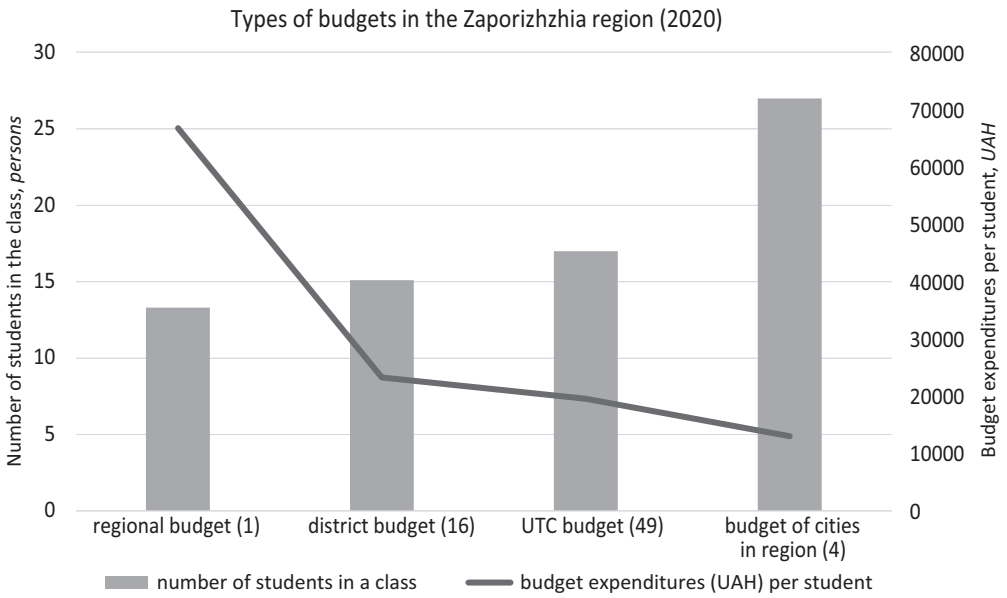

Fig. 1. **Budget expenditures per student depending on the class fill rate (in terms of local budget levels)**

Compiled by the authors according to the State Treasury Service of Ukraine.

(GSEI) financed from the regional budget. This is due both to the low fill rate of classes in such GSEIs and to the specific nature of such institutions. The regional budget finances, in particular, specialized art schools, boarding schools, including sports, military and sanatorium schools, etc.

The lowest budget expenditures per student (13031 UAH) fall on city schools. Zaporizhzhia region has four budgets of cities of regional subordination (namely, the cities of Zaporizhzhia, Energodar, Tokmak, Melitopol), which provide costs for secondary education. Schools financed from these budgets have the highest average fill rate of classes in the region – 27 students per class.

Schools financed from district budgets (16 budgets, average of 23285 UAH per student) and the budgets of the local communities (49 budgets, 19576 UAH per student) show intermediate indicators of specific budget expenditures per student.

In 2021 in Ukraine, as a result of the decentralization reform, districts were enlarged. Therefore, below we consider approaches to assessing the efficiency of budget funding on the example of the local communities (LC). The additional argument is that the number of LCs is quite significant compared to other types of territorial entities. This allows us to extend the possible ways for analysis. Figure 2 shows the budget expenditures per student and the fill rate of classes in schools funded from the LC budgets in the Zaporizhzhia region.

Fig. 2 also illustrates a pattern for the LC-funded schools: lower budget expenditures per student are associated with a higher class fill rate. The highest fill rate of classes (on average 26,1 students per class) is in Berdiansk city LC and the average cost per student

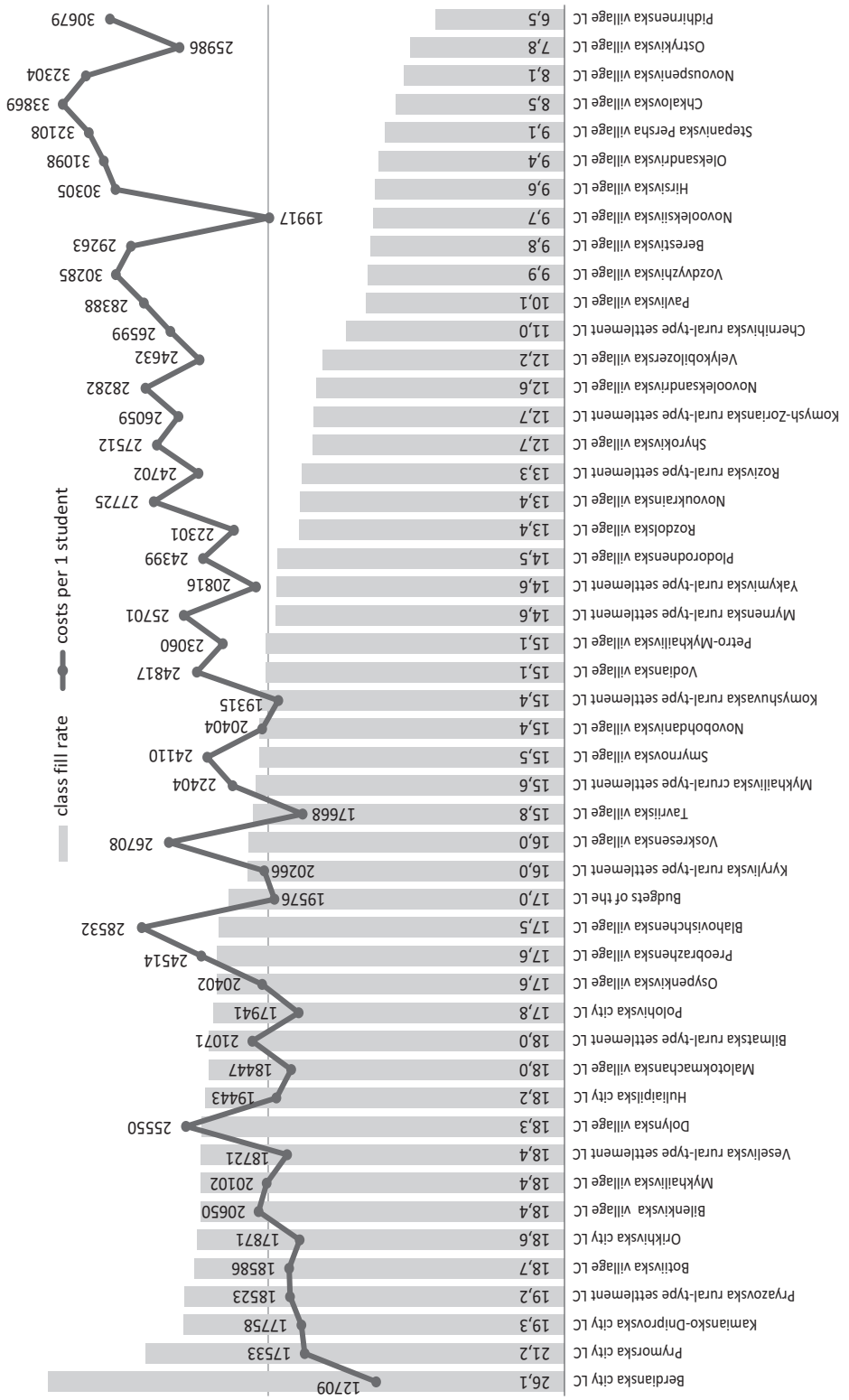

Fig. 2. **Budget expenditures per student and class fill rate for the LC budgets in the Zaporizhzhia region of Ukraine (2020)**

Compiled by the authors according to the State Treasury Service of Ukraine.

amounted to 12709 UAH. On the other side is Pidhirnenska village LC with the lowest fill rate (on average 6,5 students per class) and average expenditures per student totalled 30659 UAH. However, as can be seen from the figure, Chkalovska village LC has the highest (33869 UAH) expenditures per student, although the fill rate is 8,5 students per class and is slightly higher than in Pidhirnenska village LC.

In general, as follows from the above data, the higher the fill rate of classrooms (up to a certain limit), the higher the efficiency of the budget expenditures for secondary education. But this thesis is only partially correct. Indeed, a sufficient number of students in the classroom creates a competitive relationship between students and allows teachers to be fully occupied according to their profession, so the educational services provided should be of better quality. But determining the efficiency of budget funding solely based on class fill rate is a limited approach because it does not take into account the final result of the education – the student's knowledge and competencies (learning outcomes) that will give them the advantages in adult life. That, in our opinion, should be the main criterion for the efficient use of budget funds. And the thesis, that the higher the fill rate of classrooms, the higher the efficiency of budget expenditures for the training of one student, should be verified further.

For this reason, we can use the results of school graduates' external independent evaluation (EIE) as such indicators.

We analyzed the possibilities of a model approach to evaluating the efficiency of budget funding of schools using the EIE results as a criterion of effectiveness within the method of Data envelopment analysis (DEA).

An integral efficiency indicator may be presented as:

$$E = \frac{\sum_{i=1}^{m} \alpha_i x_i}{\sum_{j=1}^{n} \beta_j y_j}, \qquad (1)$$

where x_i – outputs associated with the useful effect, y_j – inputs related to the expenditures on schools, m and n – the number of outputs and inputs respectively, α_i and β_j – weighting factors.

The input and output parameters of the model should be based on reliable statistical data and within each group selected indicators should be independent of each other. In compliance with these requirements, the following input indicators may be chosen based on available statistical data on-budget funding of GSEIs in the LCs of the Zaporizhzhia region:

– expenditures of the educational subvention in 2020 on teachers' salaries with accruals in the GSEIs (treasury cash expenditures of the educational subvention, including fund balance as of 01.01.2021), thousand UAH (y_1);

– average expenditures of the educational subvention per student in communal GSEIs, UAH (y_2);

– average expenditures of the educational subvention for one class in communal GSEIs, UAH (y_3).

The selected inputs should be presented on a single scale by normalization according to the following formulas:

$$y_{ij}^{*} = \frac{y_{ij} - y_{i\min}}{y_{i\max} - y_{i\min}}. \qquad (2)$$

As a result, the values of the selected indicators will vary from zero to one.

The independence of the selected inputs was checked by correlation ana-

lysis. The correlation coefficients (Pearson) for different combinations of indicator pairs are: r_{12} = -0,52; r_{13} = 0,07; r_{23} = -0,15. The highest absolute value has the correlation coefficient between the indicators «expenditures of the educational subvention on teachers' salaries» and «average expenditures of the educational subvention per student», which corresponds to a moderate negative correlation. A more detailed analysis of the correlation fields for these inputs (Fig. 3) shows the absence of significant nonlinear correlation between them. It is also worth noting that the expenditures of the educational subvention on teachers' salaries (y_1) depend significantly on the size of the LC, which complicates its use in assessing the efficiency of governance at the LC level. However, there is no reason to give more weight to one of the other two indicators. Hence, it is more appropriate to calculate the integrated funding indicator *(Y)* as the average of these two indicators (y_2 and y_3).

As the output indicators of the model the results of the EIE that graduates of the LCs of the Zaporizhzhia region have demonstrated.

The analysis of the initial data showed that in three of the 49 LCs (Novooleksiivska village LC, Novoukrainska village LC and Pidhirnenska village LC) of the Zaporizhzhia region there was not a single student who received a certificate of complete general secondary education in 2020. Therefore, the data of these LCs were not included in the subsequent analysis.

The total number of indicators for which the UCEQA website provides data is too large. In particular, there are results of exams in all subjects of the EIE (11 subjects in 2020), data on the number of participants registered for each subject, the number of participants who took part in the testing, the number of those who passed the threshold of successful testing, participants' scores on the test scale and the EIE scale.

To calculate an integrated indicator of the model, we have chosen information on the results of the most mass EIE tests: in Ukrainian language and literature, Mathematics, History of Ukraine, and English language. The first of these tests is mandatory for all school graduates. In the future, it is planned that mathematics and one of the other two tests, chosen by the graduate, will also be mandatory.

When choosing output indicators of the useful effect of learning, it was

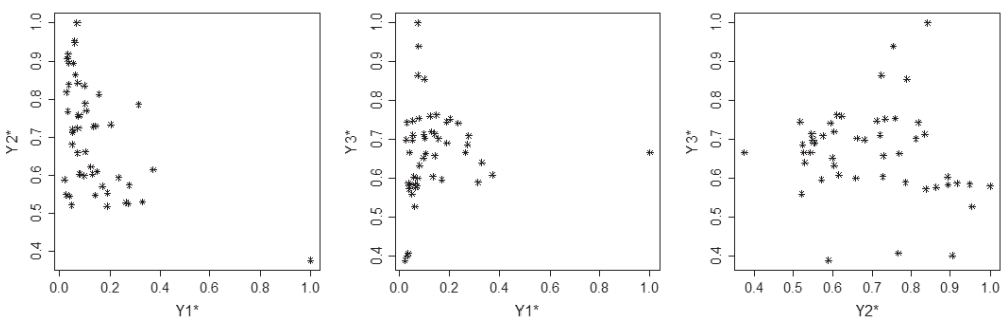

Fig. 3. **Correlation between funding indicators of general secondary education institutions in the local communities of the Zaporizhzhia region (2020)**

Compiled by the authors.

taken into account that these indicators should ensure a sufficiently complete and comprehensive assessment of educational performance. In this regard, the following generalized indicators of the EIE results were selected for the initial analysis:

– share of the total number of graduates who took part at the EIE (J_1);

– share of the total number of graduates who passed the threshold of successful testing (J_2);

– share of graduates who took part at the EIE which passed the threshold of successful testing (J_3);

– share of graduates who took part at the EIE which obtained 180 or more points (J_4).

Since four subjects of the EIE with different indicators were selected for analysis, several options for forming the aggregated indicators were considered.

In particular, the following estimates were calculated for indicator J_1:

J_{11} – the average share of the total number of graduates who took part at the EIE in the relevant subjects;

J_{12} – weighted average share of the total number of graduates who took part at the EIE in the relevant subjects for which the weighting factor of the EIE results in Ukrainian language and literature, and Mathematics were equal to 1/3, and for the EIE in History of Ukraine and English language – 1/6, according to the status of mandatory tests of the State Final Attestation (SFA) in the form of the EIE in Ukrainian language and literature, and Mathematics and selective tests in the History of Ukraine and foreign languages;

J_{13} – weighted average share of the total number of graduates who took part at the EIE in relevant subjects for which the weighting factor of the EIE in Ukrainian language and literature was equal to 1/2, and for the EIE in Mathematics, History of Ukraine and English language – 1/6, in compliance with the situation of recent years, when only the SFA in the form of the EIE in the Ukrainian language and literature was mandatory.

As can be seen from Fig. 4, there are strong linear correlations between these estimates. The correlation coefficients are presented in table.

The results achieved indicate a strong linear correlation between different variants of each indicator.

Thus, for each indicator, it is sufficient to use only one option of the estimates analysed. Therefore, in each case, simple averages were taken as the simplest and

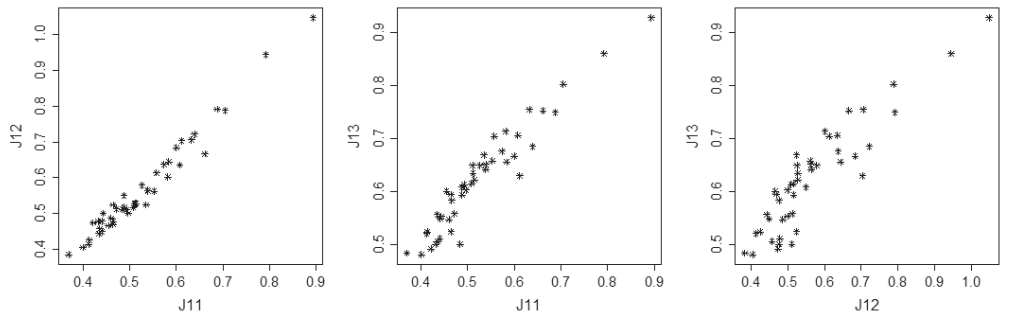

Fig. 4. **Correlation between different indicators (J_{11}, J_{12}, J_{13}) of the proportion of graduates who took the EIE as a share of total graduates**

Compiled by the authors.

Table

Correlation coefficients between different estimates for indicators J1–J4

Indicator	Correlation coefficient		
	$r_{Ji1,Ji2}$	$r_{Ji1,Ji3}$	$r_{Ji2,Ji3}$
J1	0,98	0,95	0,91
J2	0,98	0,94	0,90
J3	0,99	0,99	1,00
J4	0,99	0,98	0,99

Calculated by the authors.

most understandable estimates and the correlation between them was analysed. The relevant correlation coefficients are as follows: $r_{J11,J21}$= 0,94, $r_{J11,J31}$= -0,30, $r_{J11,J41}$= -0,14; $r_{J21,J31}$= -0,08, $r_{J21,J41}$= 0,00, $r_{J31,J41}$= 0,33.

The correlation between these indicators is presented in Fig. 5.

From the data obtained, it follows that the share of the total number of graduates who took part in the EIE and the share of the total number of graduates who passed the threshold of successful testing is close in informativeness characteristics of the results of educational activities of schools. In this regard, only the first of these indicators was chosen for further analysis.

Thus, the following indicators can be used to calculate the numerator of the integral efficiency indicator in formula (1):

– the average share of total graduates who took part at the EIE (J_{11});

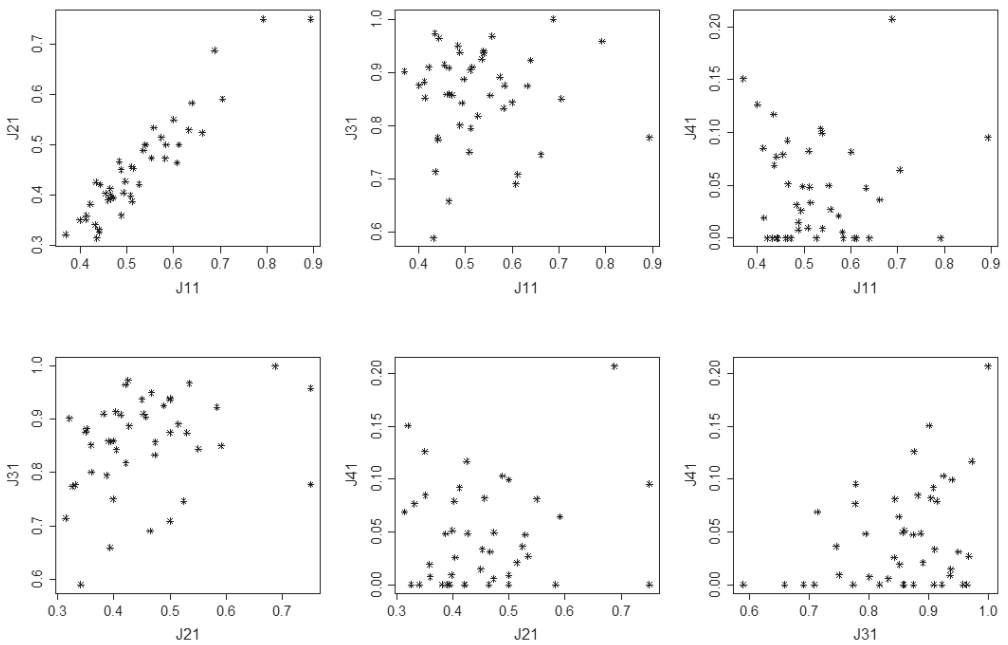

Fig. 5. **Correlation between pairs of integral indicators of the educational outcomes**

Compiled by the authors.

– the average share of graduates who took part at the EIE which passed the threshold of successful testing in different subjects (J_{31});

– the average share of graduates who took part at the EIE which obtained 180 or more points in different subjects (J_{41}).

We have analysed such variants of constructing a numerator to calculate an integral efficiency indicator by formulas (1):

$X_1 = (J_{11} + J_{31} + J_{41})/3$;
$X_2 = 0{,}5J_{11} + 0{,}25J_{31} + 0{,}25J_{41}$;
$X_3 = 0{,}6J_{11} + 0{,}2J_{31} + 0{,}2J_{41}$.

The value X_1 implies the equality of all components when X_2 and X_3 give less weight to the constituents J_{31} and J_{41} due to a certain correlation between them.

Fig. 6 shows the dependencies of efficiency indicators E_1, E_2, E_3, calculated according to formula (1) different numerators, from the value of the input indicator (integral funding indicator Y) for the LCs of the Zaporizhzhia region.

The obtained results show no significant differences in dependency when applying indicators E_1, E_2, E_3. The corresponding correlation coefficients are the following: -0,88; -0,84 and -0,81.

This means that an increase in the level of expenditures per student on average is accompanied by a decrease in efficiency. This is consistent with the above data, according to which in small-size (by the number of students) institutions of general secondary education the budget expenditures per student are higher on average and the quality of education according to EIE results is lower. The selection of variants for calculating the numerator of formula (1) may need to be further refined. Due to the amendments of the legislation on mandatory components of the EIE / SFA. In addition, the results of the 2020 EIE used in this study were clearly affected by quarantine restrictions, first of all, the fact that EIE was used mainly for those who planned to enrol in higher education institutions. For other graduates, the SFA in the EIE format in 2020 was voluntary.

Hence, both the statistical and model methods confirm the hypothesis that the quality of education typically is lower in small general secondary education institutions. At the same time, the model approach using DEA and other models or combinations thereof potentially allows solving the problems of optimizing the network of secondary education institutions. However, it should be noted that for this, in addition to the results of

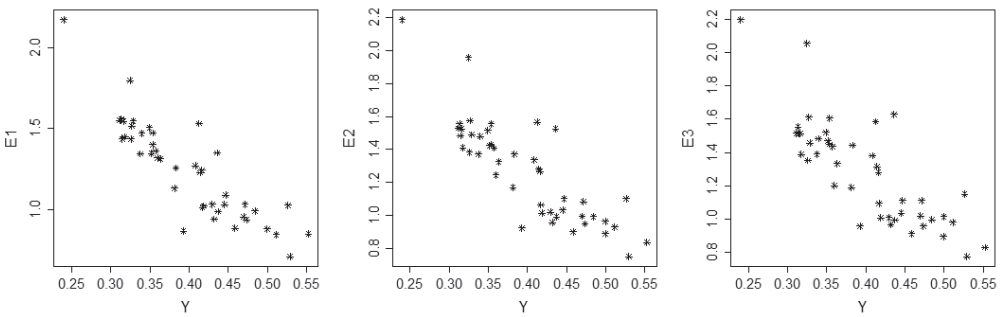

Fig. 6. **Dependencies of efficiency indicators E_1, E_2, E_3, calculated according to formula (1) using the numerators X_1, X_2, X_3, from the integral funding indicator Y for the LCs of the Zaporizhzhia region of Ukraine (2020)**

Compiled by the authors.

EIE, it is necessary to take into account other indicators of school activity, which are not reflected in the available educational statistics.

The Ukrainian government is responding to this challenge by establishing hub schools in the system of general secondary education. This process in Ukraine began with the school year 2016/2017. In hub school, as a rule, children start their education from the 5th grade, while primary education is provided in the independent primary schools, primary schools as a part of gymnasiums and lyceums (grades 1–4), or branches of hub schools (in rural areas in the case of a small number of students). The LCs, which are the founders of communal schools, provide school buses for pupils when necessary.

The dynamic of the development of the hub school network in Ukraine is presented in Fig. 7. Already in September 2016, the network had 137 hub schools with 360 branches (former small schools). As of June 1, 2021, there were a total of 1 061 hub schools and 1 579 branches. In the Zaporizhzhia region, there were currently 40 hub schools with 64 branches. As reflected in Figure 7, the formation of the hub school network is quite dynamic.

Discussion. General secondary education covers the longest and most extensive period of educational content in a person's life, when he or she forms as an individual, absorbing knowledge that has been carefully selected through the experience of previous generations, and acquires important skills for socialization. The quality of general secondary education greatly influences the formation of a country's human capital and creates conditions for the innovative development of the national economy.

The development of general secondary education is an important part of the activities of any government in the world. This requires, first and foremost, that educational activities be adequately funded. As financial resources are limited, governments are striving to

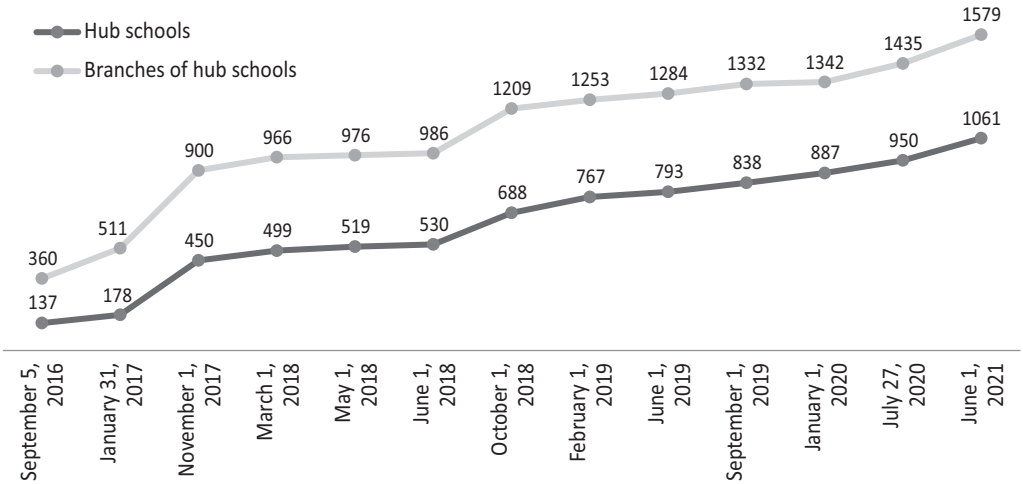

Fig. 7. **Dynamics of development of the hub schools network and their branches in Ukraine during 2016/2017–2020/2021 academic years, units**

Compiled by the authors according to the Directorate of Preschool, School, Extracurricular and Inclusive Education of the Ministry of Education and Science of Ukraine.

achieve better educational outcomes within the effective allocation of the budget for secondary education up to its total amount.

Significant funding gaps in schools arise when the education system has many small-sized schools. Such schools usually require a higher level of specific funding (funding per student), as there is a significant proportion of fixed costs that are little dependent on the number of pupils. Therefore, studies of the efficiency of budget funding, depending on the size of schools and other educational parameters, are relevant to the educational systems of all countries. Based on these studies, more informed managerial decisions can be made to create a country-specific optimal network of educational institutions.

As the results of our model study of the school network of the local communities of the Zaporizhzhia region of Ukraine show, the hypothesis has been confirmed: the efficiency of budget funding is lower for small schools. In small schools, on average, the quality of education is lower, and it is evident when graduates complete the EIE.

Although our earlier research has shown [27] that throughout the network of schools in Ukraine there are small schools in some regions of Ukraine where students show remarkably good results in the EIE. Therefore, all small schools may be divided into two groups: «problematic» and «problem-free». Based on this and subsequent studies, education authorities may be suggested to continue funding «problem-free» small schools, even though student training is more expensive here.

Decisions to optimize the school network and partially close schools, especially small ones, require an integrated approach. Small schools operate predominantly in rural areas, where the school is an important part of the public space, often the only one in small settlements. The school brings together parents and teachers and discusses various issues related to human development, the social development and organization of the economic life of the village, etc. A small school can be considered as the «embryo» of the next stage of development of the settlement. It can be closed, or it can be supported. The final decisions depend on the local communities, which can use local funds to further develop the school, as central budget funding is received based on «the state as it is», and local authorities have to evaluate and make a decision on the basis of the state «as desired to be in the future».

Known from the scientific literature and used in this paper methods to assess the efficiency of budgetary resources for schooling do not cover all the socio-economic aspects of education. A more comprehensive and multifaceted study of the problem can be carried out using multi-factor models, where the resulting value may be specific funding. In turn, factor values other than the success rate of students in the EIE may be additional social and economic factors, in particular, the possibility of socio-economic development of human settlements from local resources, infrastructure, proximity to markets, energy factors, etc. Such factors can be assessed using expert methods.

It should also be considered that the educational reform in Ukraine provides for the gradual separation of specialized high schools. The presented approach can be applied more effectively in the case of specialized schools. It requires some adaptation to primary schools and

gymnasiums, using indicators that are introduced to assess the graduates of these secondary education levels, as well as the results of monitoring studies.

Conclusion. The hypothesis that the quality of education in small schools is generally lower is justified on the basis of data for the Zaporizhzhia region. Similar results are known from literature for other countries [28]. For a more thorough analysis, the DEA method can be applied. It is shown that for this purpose the official data on budget funding of GSEIs in the LCs can be used as input indicators, and data on EIE results – as output. Different options for building such indicators were analyzed. Further, these results are expected to be refined and used for DEA analysis on the set of data for all regions of Ukraine.

Thus, finance governance in education should create and use incentives to consolidate general secondary education institutions. At the same time, future research should expand the range of socio-economic aspects that are taken into account when analysing the effectiveness of the school network, especially concerning the evaluation of activity results of small schools which are not limited to academic success.

Moreover, in addition to the learning achievement factors, it is necessary to consider additional socio-economic factors, namely, the economic development potential of the LC, its infrastructure, forecasts of demographic changes, the proximity of markets, energy factors, etc.

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МОЖЛИВОСТІ ВДОСКОНАЛЕННЯ БЮДЖЕТНОГО ЗАБЕЗПЕЧЕННЯ РОЗВИТКУ ШКІЛЬНОЇ ОСВІТИ В УКРАЇНІ

Анотація. *Стаття присвячена дослідженню можливостей удосконалення бюджетного фінансування шкільної освіти в Україні як важливої складової формування людського капіталу й інноваційного розвитку національної економіки. Актуальність статті полягає також у тому, що аналіз ефективності бюджетного фінансування мережі освітніх закладів залежно від розміру шкіл та інших освітніх параметрів є актуальним для освітніх систем усіх країн, оскільки отримані результати дають*

змогу управлінцям приймати обґрунтованіші стратегічні рішення в процесі творення освітньої політики. Мета статті – дослідити ефективність використання бюджетних коштів на фінансування загальної середньої освіти в Україні за допомогою модельного підходу на прикладі шкільної мережі Запорізької області (як типової рівнинної області без географічних особливостей і відносно рівномірно заселеної). Авторами застосовано статистичні, модельні й економіко-математичні методи аналізу даних. Зокрема, можливості модельного підходу щодо оцінювання ефективності бюджетного фінансування шкіл із використанням результатів зовнішнього незалежного оцінювання як критерію ефективності було проаналізовано за допомогою Data envelopment analysis (DEA). Для формування інтегрального показника моделі авторами статті обрано інформацію про результати наймасовіших тестів ЗНО: з української мови та літератури, математики, історії України й англійської мови. У результаті проведеного дослідження з'ясовано: у малих закладах загальної середньої освіти якість освіти загалом є нижчою, про що свідчать результати ЗНО. Зроблено висновок, що при прийнятті рішення щодо оптимізації шкільної мережі та часткового закриття шкіл, особливо малих закладів освіти й сільських шкіл, необхідно застосовувати комплексний підхід. З огляду на це освітнім фінансистам-управлінцям рекомендовано створювати та використовувати стимули для укрупнення закладів загальної середньої освіти.

Ключові слова: *заклади загальної середньої освіти, бюджетне фінансування, освітні параметри, Data envelopment analysis, зовнішнє незалежне оцінювання.*

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