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THE IMPACT OF STATE REGULATION IN A SPHERE OF EDUCATION ON SUSTAINABLE DEVELOPMENT OF NATIONAL ECONOMY

Abstract

Education is a core element of the Sustainable Development Concept. It is not only because of the declaration of SDG 4 within the 2030 Agenda but also its embeddedness in other goals, targets, and indicators. Thus, the study aims to generalize approaches to define the relationship between the efficiency of the strategy of sustainable development of the national economy and state regulation of education. The research is accomplished for 14 Central and Eastern European countries (2006–2016) using the combination of principal components method and parametric method of stochastic frontier analysis in the software package STATA 11 and FRONTIER 4.1. As a result, the empirical proofs of the strong and adequate link between the efficiency of the sustainable development strategy of the national economy and state regulation of education are identified. The technical efficiency indexes were also calculated that allowed forming three clusters for Central and Eastern European countries distributed by the level of state regulation of education and efficiency of sustainable development strategy implementation. It helps to distinguish the main measures to reform the state regulation of education in Ukraine considering the experience of Slovenia, Poland, the Czech Republic, countries that proved to be the leaders in a sphere of sustainable development strategy implementation. The recommendations for further improvements in educational policies were defined. For instance, effective and sustainable state regulation of education should focus on decentralizing education, developing private-public partnerships, stimulating adult education development, etc.

Keywords	state regulation, education, sustainable development goals, efficiency, national economy, stochastic frontier analysis, reforming
JEL Classification	I26, I28, Q01

INTRODUCTION

The sustainable development concept is widely known and attracts the interests of scholars, researchers, policy-makers, and social activists. The analysis of academic citations through the Publish or Perish software had revealed top-cited works. Among the most cited papers in the field of implementing the SDGs, the seminal work of Stafford-Smith et al. (2017) should be mentioned. This study is devoted to the conceptualization of the cooperation model between actors under the 2030 Agenda. The scholars and researchers have declared the SDGs system as a new opportunity to create a viable network of countries to integrate the efforts for a common future at a new level (Le Blanc, 2015). Interdisciplinary of the sustainable development concept and its relatedness to the education process was developed in papers of Steiner and Posch (2006) and Arbuthnott (2009). If the first work is about cross-country analysis, the other is accomplished for attitude-behavior relationships at an individual level. However, the issue of ef-

ficiency of specific systems and branches of the national economy as the subject of study in relatedness to sustainability are less frequent. The 4th SDG expresses the following vision of the desired state in a field of education 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all', according to the 2030 Agenda (UN, 2015). The SDGs achievements are at the center of scholars' and practitioners' attention, and there are many papers where debating and conceptualizing sustainable development took place. However, few studies on cross-country analysis combined the evaluation of national economic efficiency, sustainable development progress, and social institutions regulations. In this regard, the study by Lo Storto and Goncharuk (2017) on benchmarking analysis for some European countries' national healthcare systems should be analyzed. The scholars use the non-parametric frontier method based on Data Envelopment Analysis (DEA). In their work, Jikia et al. (2017) presented an approach to assessing the lifelong learning system's financial support in Ukrainian regions through stochastic frontier analysis. Similar studies on the evaluation of efficiency in specific sectors of the national economy are performed by Obeid and Brychko (2017), Kowo et al. (2019), Lambovska et al. (2019), Bercu et al. (2019).

The interlinks between SDG and progress in economies and institutions are at the center of discussions of many scholars (Kostel et al., 2017; Malyarets et al., 2019; Iacobuta et al., 2019,;Bhandari & Bhattarai, 2017; Bhandari & Shvindina, 2019; Raišienė et al., 2019). However, the institutional influence in a sphere of SDGs achievement is studied fragmentedly, mostly because the number of SDGs is significant, and the scale is global.

1. LITERATURE REVIEW

There are at least two dimensions for the literature review in the current study. The first dimension is about how to combine the previous findings on sustainability, regulations in the educational sphere, and methodology evolution in the research field. Another dimension is devoted to analyzing the previous findings in efficiency evaluation.

To start with the complex analysis of multidisciplinary research, the verified techniques and bibliometric measurement were performed. Among existing bibliometric tools, Publish or Perish software is one of the most helpful in identifying seminal, top-cited papers in the domain. Thus, the search using the combination of keywords 'state regulation', 'education', 'efficiency,' and 'sustainable development goals' was accomplished for 2019–2019. The content analysis enabled to select TOP-15 works in research out of the first 200 items ranked by Google Scholar Ranking, as shown in Table 1. Among items, there were books, conference notes, editorials, and papers. For further content analysis, the papers were selected only with a high Google Scholar Ranking (GSR). Notably, the GSR returns outcomes (as 1, 2, 3) in the order of relevance of query results. The cites ranking

may result in irrelevant papers, so in this case, three tools were combined as presented further (see Table 1). By doing so, the simplified outcomes of content analysis of selected papers are presented too (see Table 1).

Among the most cited works, the work of Martinez-Alier et al. (2010) is worth attention, where the sustainable development paradigm faces the degrowth concept. The comparison between these two flows of thinking made the disadvantages of the latter visible. The challenges in sustainable development should still be discussed in further research, especially in terms of scale and scope, ethical boundaries, technical, economic, and institutional tools.

The study that proves the urgency of radical reorientation in educational policies towards innovative strategies and sustainable development that meets the social needs (Breidlid, 2009) resonates with the study of Khalili et al. (2015) devoted to the role of academia in the promotion and acceleration of sustainable development movement. The researchers accomplished the cross-country survey to understand how cleaner production concepts may infuse academic programs and how to support sustainable development and encourage sustainable education.

Table 1. The TOP-15 most influential papers in the field of research, ranked by Google Scholar Ranking (GSR), cites, and cites per year (C/pY)

Source: Google Scholar Database search via Harzing's Publish or Perish 7.0 – by the Google Scholar Ranking, and the number of cites and C/pY – for the first round, selecting the relevant papers (excluding books, conference materials, and editorial notes) by content analysis – for the second round.

GSR	Cites	C/pY	Year of publication	Authors	Title	Methodology (simplified)
6	305	101.67	2017	Stafford-Smith et al.	Integration: the key to implementing the Sustainable Development Goals	Conceptualization (key links identified for the sectors, countries, and actors)
8	769	153.80	2015	Le Blanc	Towards integration at last? The sustainable development goals as a network of targets	Network analysis based on interpretations of the wording of the targets
10	244	61.00	2016	Costanza, Daly, Fioramonti, Giovannini, Kubiszewski, Mortensen, … and Wilkinson	Modeling and measuring sustainable wellbeing in connection with the UN Sustainable Development Goals	Conceptualization, Sustainable Wellbeing Index offered
13	299	27.18	2009	Arbuthnott	Education for sustainable development beyond attitude change	Review of previous studies
15	164	32.8	2015	Khalili, Duecker, Ashton, and Chavez	From cleaner production to sustainable development: the role of academia	Qualitative data collection and processing (questionnaire), cross-country
25	852	106.5	2012	Moldan, Janoušková, and Hák	How to understand and measure environmental sustainability: Indicators and targets	Critical analysis of contradictories in targets
32	135	19.29	2013	Yuan and Zuo	A critical assessment of the Higher Education For Sustainable Development from students' perspectives–a Chinese study	Qualitative study, students' awareness of sustainability issues (1,134 respondents)
45	142	12.9	2009	L. Simonneaux and J. Simonneaux	Students' socio-scientific reasoning on controversies from the viewpoint of education for sustainable development	Qualitative study, students' reasoning about controversial socio-scientific issues
47	265	33.13	2012	Burmeister, Rauch, and Eilks	Education for Sustainable Development (ESD) and chemistry education	Conceptualization
78	155	14.09	2009	Maroy	Convergences and hybridization of educational policies around 'post-bureaucratic' models of regulation	Conceptualization
79	185	16.82	2009	Breidlid	Culture, indigenous knowledge systems and sustainable development: A critical view of education in an African context	Case study
85	709	70.90	2010	Martínez-Alier, Pascual, Vivien, and Zaccai	Sustainable de-growth: Mapping the context, criticisms and future prospects of an emergent paradigm	Conceptualization
142	147	24.5	2014	Nazarko and Šaparauskas	Application of DEA method in efficiency evaluation of public higher education institutions	A comparative efficiency study of 19 Polish universities of technology
194	8	4.0	2018	Mohammadalizadehkorde and Weaver	Universities as Models of Sustainable Energy-Consuming Communities? Review of Selected Literature	Review of previous studies
200	7	0.78	2011	Gorobets	Corrections to the human development index and alternative indicators of sustainability	Conceptualization, Improvements for Human Development Index offered

Another qualitative study was done later (Yuan & Zuo, 2013), but for China only. The respondents (1,134 people) were students of educational institutions, and the results showed the level of awareness of sustainability issues in the community. Most Chinese institutions use a top-down approach to incorporate sustainable development. Therefore, the education may offer the optional way of implementing a bottom-up approach and the existing one.

One more qualitative study but narrowed to the case analysis and reasoning was done by French researchers L. Simonneaux and J. Simonneaux (2009). This study has a specificity (ecological niche) and yet brought the findings in the field to the academic community for further discussion.

In the content analysis process, it was revealed that most of the cited papers are devoted to the conceptualization of sustainable development (Maroy, 2009; Gorobets, 2011; Burmeister et al., 2012; Stafford-Smith et al., 2017; Costanza et al., 2016). While forming concepts, researchers offered certain solutions for solving controversialities, for instance, the Sustainable Wellbeing Index (Costanza et al., 2016) or improvements for Human Development Index (Gorobets, 2011). Some papers are remarkably representative in restructuring the findings in the domain (Arbuthnott, 2009; Moldan & Janoušková, 2012).

There are studies worth mentioning for the literature on interlinks between SDG progress, regulation policies, and education. Governments' intentions to achieve the accepted SDGs are the subject of several scientific discussions (G. Karnitis & E. Karnitis, 2017; Atkočiūnienė & Miroshnychenko, 2019). SDGs achievement requires significant changes and reforming and modifications of existing national economic systems (Malyarets et al., 2019; Iacobuta et al., 2019), as well as the institutional components (Bhandari & Bhattarai, 2017; Bhandari & Shvindina, 2019; Kostel et al., 2017; Raišienė et al., 2019). Another challenge of transformation is the issues that may appear in a sphere of reproduction of human or intellectual capital (Maslak et al., 2018; Indiyati, 2018; Palascakova et al., 2018), changes in socio-labor relations (Vorontsova et al., 2020a), possible imbalance in education (Zuzeviciute et al., 2017; Tvaronavičienė et al., 2018), etc.

Education is one of the core components of the social sector, and according to numerous theoretical and empirical studies, has a positive impact on the achievements in a sphere of sustainable development through the lens of macroeconomic stability of a country (Palienko & Lyulyov, 2018; Golovchanskaya et al., 2018), economic growth (Skliar & Samoilikova, 2014; Rungsrisawat & Pamornmast, 2019; Vaiciukevičiūtė et al., 2019), increasing the level of democracy (Mazurek & Mielcová, 2019), establishing cooperation and partnerships at the international level (Ulewicz & Blaskova, 2018; Bondar & Paszkowski, 2019), development of a lifelong learning system (Kryk, 2016). Existing pressing problems in the field of education, which are usually shared by most of the countries, have been studied by numerous scholars, including Bordean and Sonea (2018), Guziejewska and Majdzińska (2018), Volchik and Maslyukova (2019).

When considering the role and importance of education regulation in modern scientific works, it is recommended to take into account the interests of all stakeholders to ensure a global partnership (Savga et al., 2018; Degtjarjova, Lapina, & Freidenfelds, 2018; Vorontsova et al., 2020b), to support transparency and quality of educational services, and to guarantee comprehensive and equitable education (Skliar, 2018). Moreover, state regulation should take into account possible public-private partnerships and opportunities to establish them (Łyszczarz, 2016; Kuznetsov et al., 2017; Kohnová et al., 2019), specifics of financing in the industry (Vorontsova et al., 2018) and its marketing (Petrunia et al. 2019) to ensure effective knowledge transfer (Matošková, 2016; Smaliukienė, 2017; Anatan, 2018, Novikova et al., 2020) and sufficient information infrastructure (Wierzbicka, 2018; Polyakov et al., 2019).

Accordingly, the second dimension of the literature review is the comprehensive framework of efficiency evaluation, which is the bottom line of the current research.

According to the Longman Business Dictionary (2000), efficiency is considered a quality that shows "how well an industrial process, factory, or business works so that it produces as much as possible from the time, money, and resources that are

put into it". Other than that, there is a well-known approach, according to which the efficiency is a "ratio between outcome and costs (resources) to achieve it" (Andriychuk, 2005). Many studies deal with efficiency rather than effectiveness; even if both measure the performance, these terms should be distinguished properly. Detailed research of Mouzas (2006) gave a systematic understanding of similarities and differences of the mentioned terms, and in the current study, the term "efficiency" is used following the logic of DEA (Karlaftis, 2004) as a non-parametric approach to efficiency measurement. On the other hand, the effectiveness is performed at the standard ISO 9000:2015 as "the extent to which planned activities are realized, and planned results are achieved" (ISO 9000:2015, n.d.).

In the opinion of another scholar, Pylypenko (2016), the efficiency may be considered in three dimensions: (a) economic dimension – when the usage of existing resources (natural, financial, human, etc.) are compared to the achieved results; (b) organizational dimension – when the efficiency of management and decision-making system is taken into account; and (c) social – when the costs and resources (input) are compared to the social outcomes or result (i.e., social security, equity, and equality, etc.). These three types of efficiency are related to each other and allow measuring certain object at the microlevel (entity or organization) and the level of country or governance.

In this matter, the study of Nazarko and Šaparauskas (2014) should be mentioned, where the DEA method was implemented for the efficiency evaluation of public higher education institutions. This study encourages searching for a comprehensive toolbox to understand if there is a relationship between educational policies and progress in sustainable development. The mentioned study is less relevant to SDG, but more to the economic and technological efficiency of HEIs performance; still, it showed that the comparison between educational systems of different countries might be representative; therefore, the quantitative study was chosen for current research.

Talking about the efficiency evaluation methods, at least several groups of methods may be distinguished: index methods, which mean that certain

aspects or activities may be measured in absolute or relative terms, and they can be performed on average or as an integral index; the expert methods that implies surveys, focus-group, qualitative data collection and data processing, balanced assessment. The next one is econometric methods; they involve more complex econometric analysis models and various analytical tools. Moreover, there are blended methods, which combine the abovementioned. In a broad sense, all the methods of evaluating efficiency can be divided into parametric and non-parametric. For the current study, the parametric method of econometric analysis was chosen to establish the objective function and determine the influence of individual factors on the dependent variable.

Among the great variety of econometric analysis methods, stochastic frontier analysis (SFA) was chosen for several reasons. It allows determining the possible deviations of the actual and potential level of efficiency and receiving optimum value concerning the object of research. This method was first introduced by a group of scientists led by Aigner (Aigner et al., 1977) and was used mainly in production analysis. Later, it began was widely distributed in other fields, as evidenced by the works of Battese and Coelli (1992), Coelli (1996), Farrell (1957), Meeusen et al. (1977), etc.

This method's main essence is to consider a particular situation or entity (in the current case – the country) as a complex system with a set of input parameters and output parameters. In mathematical form, this method of analysis is most often expressed using the production function (Aigner et al., 1977):

$$Y_i = X_i\beta + (V_i - U_i), \ i = 1...N, \qquad (1)$$

where Y_i is level of benefits of entity (or a producer)i, $i=1,..N$; X_i is variable vector of factors for an entity (or a producer) i; β is vector of unknown parameters; V_i is standard error; U_i is inefficiency index for an entity (or a producer) i.

The stochastic frontier analysis needs a so-called efficiency limit to be established for a given situation or entity, mainly in the form of a specific regression dependence. Note that the following formula determines the evaluation of efficiency:

$$\begin{cases} EF_{(i)} = \dfrac{E\left(Y_i \mid U_i, X_i\right)}{E\left(Y_i \mid U_i = 0, X_i\right)}, \\[2mm] U_i = X_i\beta + V_i - Y_i = \beta_0 + \\[2mm] + \displaystyle\sum_{j=1}^{n} \beta_1 \ln\left(x_{ij}\right) + v_i - \ln\left(y\right), \end{cases} \qquad (2)$$

where $EF_{(i)}$ is the index of technical efficiency of activity of entity i, E is expectation.

It is important to understand that the method outlined above is based on technical efficiency and to distinguish this type of efficiency from others is crucial. For understanding the technical efficiency, the definition of Farrell (1957) who defined it as a firm's success "…in producing maximum output from a given set of inputs" (Farrell, 1957, p. 259) was accepted as initial. The same scholar noted that technical efficiency always, to some extent, reflects the quality of its inputs. Therefore, the following fact should be considered: technical efficiency is measured concerning a given set of parameters (firms), and any dynamic of inputs will affect the outcomes. However, these limitations, according to Farrel (1957), are natural.

However, despite the numerous studies listed above in this area, they remain fragmented; namely, they are either related separately to the educational sphere and the results of its activities or issues of sustainable development and related transformations in the national economy, or efficiency evaluation. Based on this, the current study aims to generalize approaches to define the relationship between the efficiency of the strategy of sustainable development of the national economy and state regulation of education.

2. RESEARCH METHODS

At the first stage, the data set is formed. In the current study, identifying independent, additional, and dependent variables and data collection took place. As dependent variables, the unified integral index of SDGs achievements (I_{SDG}) was calculated and, therefore, the progress in implementing the respective strategies in different countries.

The source of data is the World Bank Database (Sustainable Development Goals Data) for 14 coun-

tries, namely for Bulgaria (BGR), Belarus (BLR), Czech Republic (CZE), Estonia (EST), Hungary (HUN), Latvia (LVA), Lithuania (LTU), Moldova (MDA), Poland (POL), Romania (ROU), Russian Federation (RUS), Slovakia (SVK), Slovenia (SVN), Ukraine (UKR). The period is 2006–2016.

The integral index calculation method is based on indicative SDGs formed using principal component analysis. Firstly, it provides normalization by comparing initial data with maximum and minimum values (for stimulants and destimulators). Secondly, the components' weight determination takes place according to their correlation proportion and dispersion. Thirdly, the integral index is calculated by the weighing of normalized data. It should be noted that the same algorithm is accomplished for each SDG, and then the integral index for all SDGs achievements is performed.

The second stage is about forming the factors that influence the process of achieving SDGs. In the current study, two groups are considered – 1st group, "Harmonization of the Educational Environment under the State Regulation of Education (HE)," and 2nd group of additional corrective variables that reflect the set of parameters that indicate specialization of a national economy (NEI).

The third stage is about to design an appropriate model based on the parametric method of stochastic frontier analysis and verification of its adequacy. As mentioned earlier, within the SFA framework, the function has a production form and may take many forms depending on specification. The most common is the Kobb-Douglas function or its complicated version – the translogarithmic function. The reliability and adequacy of the obtained results of performance evaluation depend on the choice of specification. The maximum likelihood ratio test was used to compare the criteria set of the Kobb-Douglas function and the translogarithmic function to select the analysis method.

The calculations were performed via software FRONTIER 4.1. and STATA 11.

The last stage of the study is cluster analysis using the results of parameter values and the interlinks between them.

3. EMPIRICAL RESULTS

The following values of integral indexes were obtained at the first stage and compared for 2006 and 2016 (see Figure 1).

At the second stage, the following components for the groups of variables were offered:

- 1st group "Harmonization of the Educational Environment under the State Regulation of Education (HE)" is represented by the variables as follows: state funding of education (amount of allocated funds), total education coverage ratio, teacher-student ratio in preschool, primary, secondary and higher education, duration of compulsory schooling;

- 2nd group of additional corrective variables that reflect the set of parameters that indicate specialization of a national economy (NEI): indicators of change in GDP, GNI,

the share of agriculture, industry, and services in the economy, the share of exports and imports of goods and services, and exports of high-tech ICT technologies and services, etc.

The results of the maximum likelihood ratio test are performed further. This method compares the criteria set of the Kobb-Douglas function and the translogarithmic function (see Table 2).

The calculation results proved the necessity of using a translog function (3), which is more flexible and involves various types of dependencies of outcomes on inputs.

$$\ln I_{SDG(i)} = \beta_0 + \beta_1 \ln\left(HE_{(i)}\right) + \beta_2 \ln\left(NEI_{(i)}\right) +$$
$$+ \beta_3 \ln\left(HE_{(i)}\right)^2 + \beta_4 \ln\left(NEI_{(i)}\right)^2 + \qquad (3)$$
$$+ \beta_5 \ln\left(HE_{(i)}\right) \ln\left(NEI_{(i)}\right) + \left(V_i - U_i\right), \; i = 1 \ldots N,$$

Table 2. The results of the maximum likelihood ratio test for Kobb-Douglas function and the translogarithmic function (criteria are formed based on Eling and Luhnen (2008))

Source: Authors' calculations via software FRONTIER 4.1.

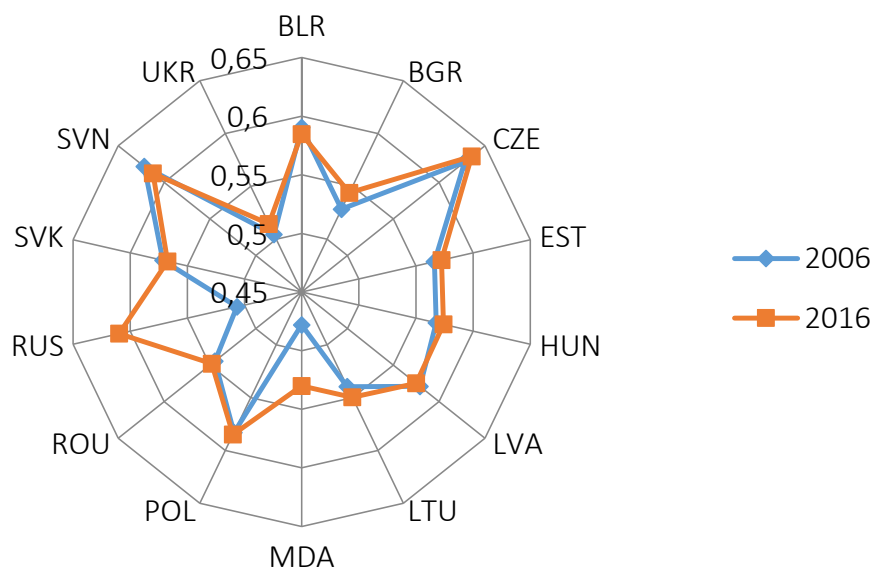| Functions	Log likelihood function (L)	χ^2	LR test	λ	Result
Kobb-Douglas function (1)	160,94		88,21	0,21	Declined
Translogarithmic function (2)	349,36	9,48	465,04	0,99	Approved
Comment	2 > 1	–	LR > χ^2	$\lambda < \chi^2$	–

Figure 1. The integral index of SDGs achievements in the sample of Central and Eastern European countries, 2006 and 2016 (based on authors' calculations)

where $I_{SDG(i)}$ is integral index of SDGs achievements of the i-th country; HE is harmonization of the educational environment under the state regulation of education indicators; NEI is specialization of a national economy indicators; β is vector of unknown parameters; U_i is non-negative random variables, assumed to account for technical inefficiency; V_i is random variables.

The results of the evaluation of the parameters based on the translogarithmic function are presented in Table 3. These calculations describe the relationship between harmonizing the educational environment (HE) and the efficiency of sustainable development strategies implementation in selected countries (NEI).

Table 3. Estimation of the translogarithmic function for the identification of a relationship between state regulation of education (HE) and the efficiency of sustainable development strategies implementation (NEI)

Parameter	Coefficient	Standard error	*t*-statistics
β_0	0.673	0.021	23.103
β_1	0.866	0.008	9.859
δ_0	0.179	0.036	5.235
σ^2	0.000	0.000	2.665
λ	0.999	0.000	135.506

The evaluation presented above revealed the following dependencies that are adequate and statistically significant:
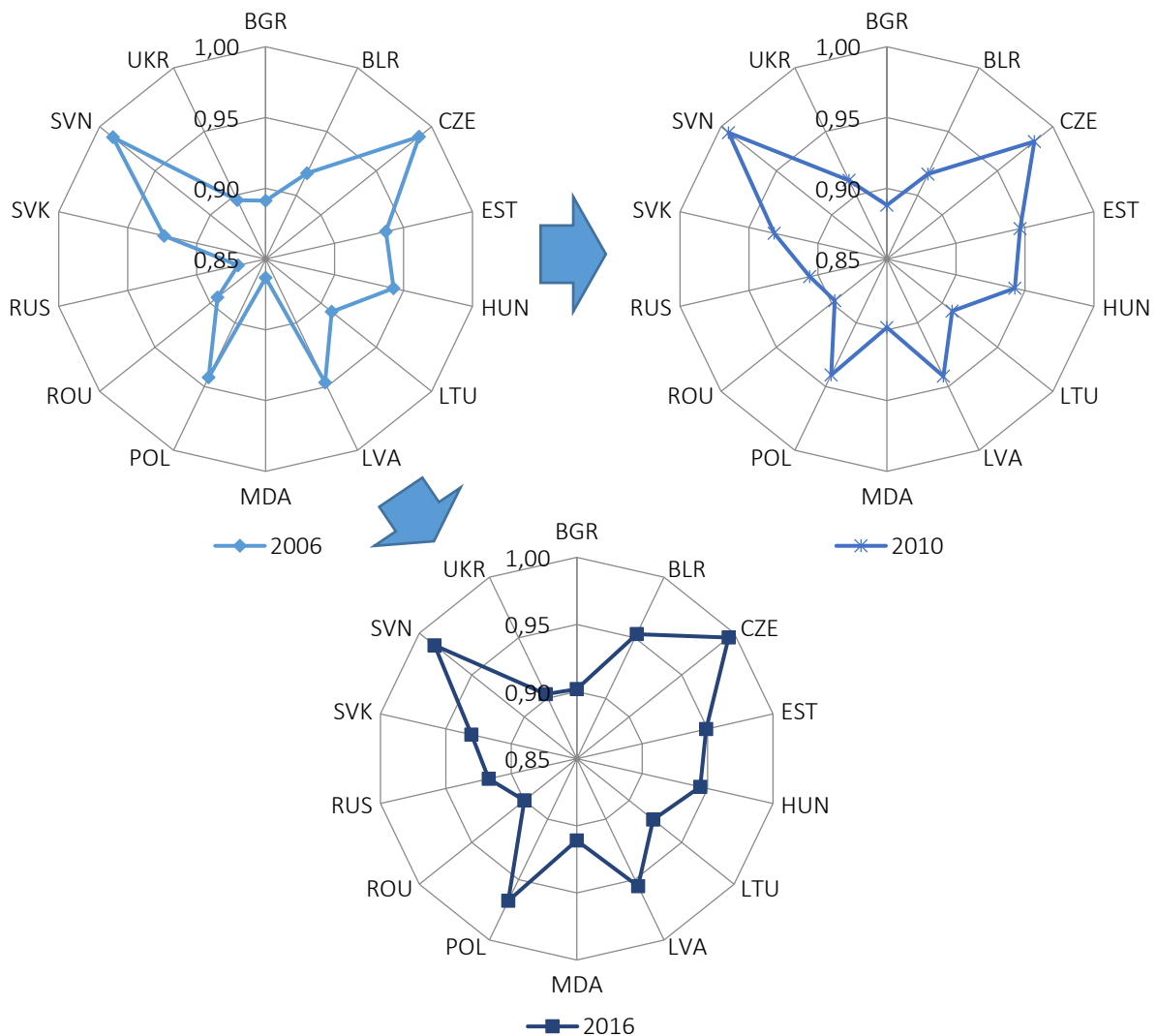

Figure 3. The integral index of efficiency of sustainable development strategy implementations in the sample of Central and Eastern European countries, 2006, 2010, and 2016 (based on authors' calculations)

- with the growth of the efficiency of state regulation of education, the integral index of achievement of the SDGs will increase by 0.866;

- another positive correlation was revealed for sectoral and technological specialization; as the additional parameter increases, the SDGs' achievements integral index will increase by 0.179.

So far, the results were obtained for the technical efficiency indexes and integral index of efficiency of sustainable strategy development related to the state regulation of education and presented in comparison for 2006, 2010, and 2016 (see Figure 3). The results are between 0.8 and 1.0, indicating the high level and becoming the basis for the cluster analysis for the mentioned countries.

The visual analysis allows identifying leaders of sustainable development strategies implementa-

tion in terms of technical efficiency. The leaders are the Czech Republic and Slovenia, and outsiders are Romania and Bulgaria (in 2016). To study the changes of this indicator within the group of analyzed countries, they were divided into three clusters, defining a uniform range of the interval (table 4).

As a result, the leaders with a high level of influence of state regulation of education on the efficiency of the strategy of sustainable development of the national economy were identified (primarily Slovenia, the Czech Republic, and in 2016 – Poland). On the other hand, Ukraine has consistently remained in the first cluster, which shows signs of a low level of efficiency in the implementation of the sustainable development strategy.

In this regard, the main measures to reform the state regulation of education were revealed, which should be taken into account for Ukraine to increase the efficiency of the strategy of sustainable

Table 4. Clusters of Central and Eastern countries distributed by the level of state regulation of education and efficiency of sustainable development strategy implementation

Year	Cluster identification	Quantity	Countries
CLUSTER 1 (LOW LEVEL OF IMPACT)			
2006	$E_{SDS} \in [0,86; 0,91)$	5	Moldova, Russian Federation, Bulgaria, Romania, **Ukraine**
2008	$E_{SDS} \in [\cdot,88;0,91)$	6	Moldova, **Ukraine**, Romania, Bulgaria, Lithuania, Russian Federation
2010	$E_{SDS} \in [0,89;0,92)$	7	Bulgaria, Romania, Moldova, Russian Federation, Lithuania, **Ukraine**, Belarus
2012	$E_{SDS} \in [0,89;0,93)$	6	Bulgaria, Romania, Moldova, Lithuania, Belarus, **Ukraine**
2014	$E_{SDS} \in [0,90;0,93)$	6	Romania, Bulgaria, **Ukraine**, Moldova, Belarus, Lithuania
2016	$E_{SDS} \in [0,90;0,93)$	7	Romania, Bulgaria, **Ukraine**, Moldova, Russian Federation, Lithuania, Slovak Republic
CLUSTER 2 (MIDDLE LEVEL OF IMPACT)			
2006	$E_{SDS} \in [0,91;0,95)$	6	Lithuania, Belarus, Slovak Republic, Estonia, Hungary, Poland
2008	$E_{SDS} \in [0,91;0,95)$	6	Slovak Republic, Belarus, Estonia, Hungary, Poland, Latvia
2010	$E_{SDS} \in [0,92;0,96)$	5	Slovak Republic, Poland, Latvia, Hungary, Estonia
2012	$E_{SDS} \in [0,93;0,96)$	6	Russian Federation, Slovak Republic, Poland, Hungary, Estonia, Latvia
2014	$E_{SDS} \in [0,93;0,96)$	6	Slovak Republic, Hungary, Russian Federation, Poland, Estonia, Latvia
2016	$E_{SDS} \in [0,93;0,96)$	4	Hungary, Estonia, Belarus, Latvia
CLUSTER 3 (HIGH LEVEL OF IMPACT)			
2006	$E_{SDS} \in [0,95;0,99]$	3	Latvia, Slovenia, Czech Republic
2008	$E_{SDS} \in [0,95;0,99]$	2	Czech Republic, Slovenia
2010	$E_{SDS} \in [0,96;0,99]$	2	Czech Republic, Slovenia
2012	$E_{SDS} \in [0,96;0,99]$	2	Czech Republic, Slovenia
2014	$E_{SDS} \in [0,96;0,99]$	2	Czech Republic, Slovenia
2016	$E_{SDS} \in [0,96;0,99]$	3	Poland, Slovenia, Czech Republic

development of the national economy. The best practices from Poland, Slovenia, and the Czech Republic (the leaders in technical efficiency) are promising for implementations (see Table 5).

Table 5. Guidelines for reforming the system of state regulation of education, using best practices of Poland, the Czech Republic, and Slovenia

Country ???	Guidelines ???
Best practices from Poland	Centralized and decentralized governance combination
	Private-public partnership
	Development
	Fundraising for the development of education (i.e., vocational and technical education)
	Formal education framework expansion at state regulation level
Best practices from the Czech Republic	The dominance of decentralized governance and diversification of the education
	Autonomy of education institutions
	The legal implementation of digitalization of education for adults
Best practices from Slovenia	Centralized management for secondary, vocational higher, higher education and partially adult education
	Decentralized management for preschool and primary education, adult education
	The combination of formal and informal education for adults
	Coordination of the state regulation of education and the Sustainable Development Goals Program

Besides the mentioned in Table 5, there are several more promising directions of the reforming. Firstly, one of them is the lifelong learning concept and adult learning development. Another is a private-public partnership; for instance, the relationships "Employers – HEIs and stakeholders – Government" can be established in a sustained system. That triad system will generate opportunities in labor markets via contractual and mutually beneficial relationships between employers and educators. It will lead to the creation of new hubs and networks through the innovations boost, direct educational services

supply chain, etc. Otherwise, the labor migration will go on and will increase the depopulation crisis in Ukraine. The cooperation between the institutions may be implemented through many forms and models, for instance, known as the coopetition model of institutional partnership, and that can be a direction for further research.

4. DISCUSSION

Nevertheless, the study reveals the relationship between the state regulation of education and the sustainable development of the national economy; there are limitations and knowledge gaps to be further investigated. For instance, Switzerland is a leader in green economy development; therefore, sustainable development strategy efficiency is high there, while Scandinavian countries are the leaders in terms of quality of education. The current study focuses on Central and European countries owing to the shared history and similarities of institutions, and for the same reason, the sample is accepted as representative. For the more verified results, the sample of data should be expanded and include the pure leaders in education (Finland) and pure leaders in green innovations (Switzerland) to reveal the patterns. Besides, the stakeholder factors are left beyond the study and components that show transparency and quality of educational services. The challenges in scaling up the transformations in the sphere of sustainable education were addressed but partly, only in a sphere of state regulations. One more aspect should be investigated – the informal education and its influence on the market players' behavior via consulting (Goncharova, 2015) and their sustainability-related practices.

Despite these limitations, the research proved the interlinks between educational policies, educational technologies, ploys and patterns, and sustainable development movement outcomes.

CONCLUSION

The study confirms the dependence of the efficiency of the strategy of sustainable development of the national economy on the state regulations of education for selected countries of Central and Eastern Europe. As the modeling showed, the harmonization of the educational environment has almost 4.8 times more impact on the efficiency of the strategy of sustainable development of the national economy than the national economy's sectoral and technological specialization.

The main contribution of the research is formed methodology for cross-country comparison of achievements in the fields of education and sustainable development. Moreover, this study combines the evaluation of national economic efficiency, sustainable development progress, and social institutions regulations indicators.

The empirical results allowed clustering the sample countries and determining the list of measures to reform the system of state regulation of education in Ukraine, depending on the leading countries' experience, taken as a guide. Ukraine, being in the cluster with the lowest level of influence of state regulation of education on the efficiency of the strategy of sustainable development of the national economy, should focus on the insights from the leaders (Poland, Czech Republic, Slovenia), defining features of decentralization of education, developing private-public partnership, stimulating the development of adult education, etc.

The best practices performed in countries-leaders may become a basis for the roadmap of future reform development, which may become a beacon for further research.

By proving the dependence of the national sustainable development strategy's integrated efficiency on the interventions and regulations of government in the sphere of education, the key guidelines for further transformations in Ukraine are justified. One of the most promising directions is a private-public partnership in the field, educational services providers' autonomy, and support of lifelong learning concept and education for adults.

AUTHOR CONTRIBUTIONS

Conceptualization, supervision: Hanna Shvindina.
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