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Education Efficiency, Factor of Sustainable Development. An Analysis in Macro 4 Development Region of Romania

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1. Introduction

- The sustainable development, in the conditions of current and future economic and social systems, involve the transition to the knowledge-based economy with implications for education systems, especially since improving education and skills is a key part of the overall vision for digital transformation in Europe .

- In the context of sustainable development, the investments in education and the ensuring of the population's health are a priority, especially since their level together with the level of economic development contributes to the formation of the image of human development, Romania being from this point of view in the middle of the ranking of European states.

- The paper aims to identify how the development of high school IT infrastructure and the share of teachers per 100 students influenced the performance of the baccalaureate exam in development regions and counties included in Macro region 4 in Romania.

2. Methodology

- The main objectives of the paper were **to determine and analyze the correlations** between the outcome variables , representing the share of graduates with baccalaureate degrees in the total of high school graduates at the level of each regional structure (z_B / G) and the corresponding factor variables (z_TS / ST and z_PC / ST), representing teaching staff and personal computers per 100 students, as well as identifying and testing regression models that describe the functional links between these variables.

The significances and units of variables used

Indicator	Signification	Units
GBD	Graduates with a baccalaureate degree.	number
TS	Teaching staff	number
PC	Personal computers	number
STD	Students	number
GDT	High school graduates	number
TS/ST	Teaching staff per 100 students	%
PC/ST	Personal computers per 100 students	%
B/G	Share of graduates with baccalaureate degree in the total of high school graduates	%

- The bilateral t test (Student) was used to test the statistical significance of the correlation coefficient values, and the ANOVA methodology with the F test (Fisher) was used to verify the validity of the regression models.

3. Results and discussions

3.1. Correlations and non-correlations (1)

- At the level of Macro 4, for the analyzed period, a very strong correlation is highlighted (Table 2) between the share of graduates with baccalaureate degree in the total of high school graduates and the two indicators regarding teaching staff per 100 students and personal computers per 100 students, which highlights their importance on the quality of performance of the education system.

Table 2. Correlation coefficients and Sig. (2-tailed) for Macro 4 and its regions

County	Correlation	B/G	PC/ST	TS/ST
MACRO 4	Pearson Correlation	1	0.947**	0.958**
	Sig. (2-tailed)		0.000	0.000
South_West Oltenia	Pearson Correlation	1	0.875**	0.876**
	Sig. (2-tailed)		0.004	0.004
West	Pearson Correlation	1	0.847**	0.907**
	Sig. (2-tailed)		0.008	0.002

**. Correlation is significant at the 0.01 level (2-tailed).

3. Results and discussions

3.1. Correlations and non-correlations (2)

- Of the five component counties of the South-West Oltenia development region, only for Dolj and Vâlcea counties the dependencies between share of graduates with baccalaureate degree in the total of high school graduates and teaching staff and personal computers per 100 students are statistically significant (Table 3).

Table 3. Correlation coefficients for the counties of South-West Oltenia region

County	Correlation	B/G	PC/ST	TS/ST
Dolj	Pearson Correlation	1	0.821*	0.712*
	Sig. (2-tailed)		0.012	0.050
Gorj	Pearson Correlation	1	0.269	0.197
	Sig. (2-tailed)		0.519	0.639
Mehedinti	Pearson Correlation	1	-0.297	-0.070
	Sig. (2-tailed)		0.475	0.868
Olt	Pearson Correlation	1	0.201	0.215
	Sig. (2-tailed)		0.634	0.609
Vâlcea	Pearson Correlation	1	0.677	0.770*
	Sig. (2-tailed)		0.065	0.026

*. Correlation is significant at the 0.05 level (2-tailed).

These non-correlations highlight the fact that although the increase in the number of teaching staff and personal computers per 100 students are ways to increase the efficiency of education, in these counties, during the analyzed period, there were other aspects, with dominant negative impact, on the efficiency of the education system.

3. Results and discussions

3.1. Correlations and non-correlations (3)

- In the case of the West development region, of its six component counties , only one county identified a non-correlation between the share of graduates with baccalaureate degree and personal computers per 100 students, respectively in Arad County. The highest values of the correlation coefficients between the analyzed indicators were registered in Hunedoara County.

Table 4. Correlation coefficients for the counties of West development region

County	Correlation	B/G	PC/ST	TS/ST
Arad	Pearson Correlation	1	0.594	0.674
	Sig. (2-tailed)		0.120	0.067
Caras-Severin	Pearson Correlation	1	0.881**	0.559
	Sig. (2-tailed)		0.004	0.060
Hunedoara	Pearson Correlation	1	0.862**	0.969**
	Sig. (2-tailed)		0.006	0.000
Timis	Pearson Correlation	1	0.774*	0.869**
	Sig. (2-tailed)		0.024	0.005

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

3. Results and discussions

3.2. Quantitative and qualitative aspects (1)

- The analysis of the values of the regressors (coefficients b) highlights the fact that the most important role in increasing the performance of students enrolled in high school in this region is teaching staff per 100 students, increasing by one percentage point can lead to increased student performance by 1.51 to 5.22 percentage points, the most probable increase being 3,367 percentage points.

Table 5. Regression models and qualitative indicators at South-West Oltenia region level

Model	R	R^2	Sig.F	Regressor	t	Sig.t	Lower	Upper
SWBG(CP/ST)	0.857	0.766	0.004	1.115	4.28	0.004	0.49	1.73
SWBG(TS/ST)	0.876	0.767	0.004	3.367	4.45	0.004	1.51	5.22

Source: elaborated by authors using SPSS

- The increase of the two factors can increase the performance of students only in proportion of 76.7% in the case of TS / ST, respectively 76.6% in the case of PC / ST, which means that 24% of the increase in student performance is due to other factors.

3. Results and discussions

3.2. Quantitative and qualitative aspects (2)

- Of the 5 counties included in the South-West Oltenia development region, only in the case of two counties (Dolj and Vâlcea) significant correlations were identified between the analyzed variables. The characteristics of the regression models corresponding to them (Table 6) highlight their validity (statistical significance) (Sig.F $<\alpha = 0.05$).

Table 6. Regression models and qualitative indicators of South-West Oltenia counties

Model	R	R^2	Sig.F	Regressor	t	Sig.t	Lower	Upper
DJBG(CP/ST)	0.821	0.674	0.012	1.925	3.53	0.012	0.591	3.27
DJBG(TS/ST)	0.702	0.439	0.050	5.082	2.45	0.050	0.01	10.16
VLBG(CP/ST)	0.677	0.459	0.026	1.599	2.26	0.065	0.21*	2.98*
VLBG(TS/ST)	0.770	0.592	0.026	5.759	2.95	0.026	0.98	10.53

*. Values corresponding to the 90% confidence factor ($\alpha = 0.10$).
Source: elaborated by authors using SPSS

- Regarding their parameters, the corresponding confidence factors are different. Thus, in the case of parameter b, except for the one in the VLBG model (CP / ST) which is statistically valid for 90% confidence level ($\alpha = 0.10$), the others are statistically significant for 95% confidence level ($\alpha = 0.05$).

3. Results and discussions

3.2. Quantitative and qualitative aspects (3)

- Analyzing the models at the level of the West development region, it can be noticed that both models (Table 7) are statistically significant (Sig.F = 0.008 and Sig.F = 0.002 are smaller than $\alpha = 0.05$). At the same time, the values of the regressors are statistically significant for 95% confidence level.

Table 7. Regression models and qualitative indicators at West region level

Model	R	R^2	Sig.F	Regressor	t	Sig.t	Lower	Upper
WBG(CP/ST)	0.847	0.717	0.008	1.841	3.91	0.008	0.69	2.99
WBG(TS/ST)	0.907	0.822	0.002	7.434	5.26	0.002	3.98	10.89

Source: elaborated by authors using SPSS

- As in the case of the South-West Oltenia development region, and at the level of the West region, in increasing the performance of students enrolled in high school, a significant role is played by teaching staff per 100 students, only that this increase is much higher (on average by 7,434 percentage points). This statement is further justified by the share of 82.2% those TS / ST returns in increasing student performance, CP / ST contributing only 71.7%.

3. Results and discussions

3.2. Quantitative and qualitative aspects (4)

- At the level of the West region (table 8), for all 4 counties, significant correlations were identified, but not between all between the analyzed variables (except for Arad county for the CP variable and Caraş-Severin for TS). Most counties have regression models valid for 95%, taking into account Sig.F $<\alpha = 0.05$ (Table 8), except for Arad County where the validity of the model is for Sig.F $<\alpha = 0.1$.

Table 8. Regression models and qualitative indicators of West counties

Model	R	R^2	Sig.F	Regressor	t	Sig.t	Lower	Upper
ARBG(TS/ST)	0.674	0.454	0.067	6.745	2.23	0.067	0.88*	12.61*
CSBG(CP/ST)	0.872	0.760	0.005	3.962	4.36	0.005	1.74	6.18
HDBG(CP/ST)	0.862	0.743	0.006	2.538	4.16	0.006	1.05	4.03
HDBG(TS/ST)	0.969	0.939	0.000	11.177	9.57	0.000	8.32	14.04
TMBG(CP/ST)	0.774	0.599	0.024	1.391	2.99	0.024	0.25	2.53
TMBG(TS/ST)	0.869	0.765	0.005	6.153	4.31	0.005	2.68	9.65

*. Values corresponding to the 90% confidence factor ($\alpha = 0.10$).
Source: elaborated by authors using SPSS

- The results showed a good orientation towards efficiency in the education systems in Caraş-Severin and Hunedoara counties

Conclusions

- The paper analyzed the influence of high school IT infrastructure and the share of teachers per 100 students on the performance of graduates after taking the baccalaureate exam, at the level of development regions and counties included in Macro region 4 in Romania.

- The application of correlation and regression methods showed that an increase in the number of teachers per 100 students enrolled in high school, as well as an increase in the endowment of computers in high schools has led to an increase in efficiency and quality of education. The results show a good orientation towards efficiency in the education systems from Dolj, Vâlcea counties from the South-West Oltenia region, respectively in Caraş-Severin, Hunedoara, counties of the West region.

- It must be emphasized that the radical improvement of the education system and the diversification of the educational offer are of strategic importance, all the more so as they will lead to an efficient labour market and a stronger economy.

Any questions?

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