

# EVALUATION OF THE CONTRIBUTION OF QUALITY EDUCATION TO THE ACHIEVEMENT OF SUSTAINABLE DEVELOPMENT GOALS

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## Abstract

*The foundations of today's society include globalization, information, communication technologies, knowledge-based economy, innovation and science. As a result, future development will be determined by the capacity of individuals to acquire the technologies of the 21st century and to innovate and improve upon what currently exists. This article explores the influence of various indicators related to the quality of education on the Sustainable Development Goals (SDGs) in EU Member States. This study's findings reveal the dynamics and the relationship between the selected indicators. Metrics such as mean years of schooling, lifelong learning, the rate of school dropouts and the number of new Ph.D. graduates demonstrate the significance of quality education to the achievement of the sustainable development goals. This article includes additional factors, such as the Human Development Index and R&D investment, to provide a broader picture of how education positively influences the SDGs Index. According to the findings, development through education is a concept whose materialization consists of the intersection between investments in education and research and the participation of young talent in the national labor market.*

**Keywords:** sustainability, development, education, research, competencies, school dropout

**JEL Classification:** O11, O15, O21, O31

## 1. Introduction - The importance of quality education for development

Given the current challenges Europe is facing, such as the energy crises, the rising inflation, the consequences of the pandemic and the conflict in the east, strategies and models are required to ensure the population's well-being. From the variety of possible strategies, this article addresses those that refer to development through education.

Development represents a general goal towards which every country invests various types of resources. Sustainable development represents the solution to both modern problems and potential future problems. Development implies that every individual has access to quality education and communication technologies. Therefore, the risks of poverty and hunger are limited. In addition, sustainable development assures the optimum conditions for education to have its positive impact towards economic growth, without the accentuated consumption of nonrenewable resources.

Sustainable development for the 2030 horizon has its core signification determined by a sum of different goals from various fields. Based on the Sustainable Development Goals (SDGs - established by the United Nations General Assembly in 2015) vision, for a country to develop in a sustainable manner, the following 17 goals, each having a share of equal importance, must be accomplished: no poverty, no hunger, well-being, quality education, gender equality, clean water, affordable energy, economic growth, innovation & infrastructure, reduced inequalities, sustainable cities, responsible consumption, climate action, life below water & on land, justice and strong institutions. The global average of the SDGs Index Score for a number of 177 countries in 2021 is of 66.9 (data processed from [SDGs Index](#)), whereas the long-term value is of 100. Sustainable development is a subject addressed differently by countries of different levels of development. While the top developed countries have to focus on their spill over effects and environment friendly actions, the countries with lower levels of development have to focus on diminishing poverty, hunger and offering primary and secondary education to children ([Osunyikanmi, 2018](#)).

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The sustainable development goal addressing quality education has as its first subobjective the rate of participation in pre-primary organized learning for children aged 4 to 6. Regarding this indicator, the global data for the year 2021 (data processed from [SDGs Index](#), indicator name 'n\_sdg4\_earlyedu'), including the data available for 177 countries, points to an average value of 63.4, whereas the long term objective is a value of 100. The higher the value, the greater the number of children participating in this type of education. The relevance of this subobjective is given by the importance that early childhood development (ECD) has towards the improvement of health, education and productivity of the future human capital of a nation. The second subobjective is represented by the net primary enrollment rate. The average value is of 85.7 and the long-term value is of 100 ( data processed from [SDGs Index](#), indicator name 'n\_sdg4\_primary'). The higher the value, the greater the number of children who have attend this level of education. The third and fourth subobjectives address the lower secondary completion rate and the literacy rate. The average values for 2021 are of 72.3 and 82.8 respectively data processed from [SDGs Index](#), indicator name 'n\_sdg4\_second' and 'n\_sdg4\_literacy'). These values highlight the importance basic education has towards the achievement of the sustainable development goals. Thus, reaching the target values of 100 assures that all children have completed at least the lower secondary education and that all adults have the minimal literature competencies.

The heart of a nation's strength is its educational system, which must be of the best quality. To help individuals to compete globally, a nation must provide calibrated education ([Malik, 2018](#)). This quality education refers to skills and abilities that allow the individual to efficiently use the elements characteristic to the digital era, to work in different types of settings in order to accomplish common goals, to have a innovative, creative and critical approach towards problem solving. Furthermore, quality education also has a positive impact on employability ([Rusu and Bătușaru, 2021](#)). Today's intellectual work environments are characterized by complexity and competitiveness, thus it is mandatory that students are offered quality education. In addition to employability, quality education must be linked to lifelong learning through teaching students to learn on their own (how to find information, how to analyze it, how to turn it into knowledge, how to apply it).

Among the challenges that the educational system faces at a global scale are: the rate of school dropout, the number of pupils scoring low in the PISA tests, the degree of digitalization, the extent of adults participating in educational or training programs and even the public expenditure with education ([Malik, 2018](#)). The importance of these indicators towards sustainable development is further outlined by the fact that in today's economies, the share of productivity of the industrial sector has been replaced by technology, knowledge and innovation. The rapid changes in economies and technologies must be met by an equal degree of individual's training, education and abilities. Therefore, the rate of school dropout limits not only the possibilities for innovation, knowledge sharing or employment, but also the degree by which the individual can adequately utilize basic technologies. To some extent, this statement can occur in the case of lifelong learning as well. In order to cope with this type of change, individuals must further enrich their knowledge through training programs. Further on, the percentage of pupils that are low achievers in science, reading and mathematics tests represent a key indicator for the quality of education ([Sulis et al., 2020](#)). This, together with the rate of school dropout, represent a series of problems directly affecting the possibilities for development.

A country's average level of IQ has been shown to be statistically related to economic growth ([Lynn et al., 2002](#)). In addition to this, the importance of human capital in the knowledge based economy was highlighted through the relationship between motivation, knowledge, performance and innovation ([Rusu et al., 2022](#), [Koudelková et al., 2015](#), [Jones et al., 2006](#)).

In order to highlight the importance of education towards development, a correlation analysis between the HDI and the PISA tests' scores was performed and presented in table 1. The subject of the analysis consists of the OECD countries + Romania and targets the years 2006, 2009, 2012, 2015, 2018 ( processed data from [PISA](#) and [HDI](#) )

**Table 1. Correlation analysis of PISA scores and HDI**

Correlations		Reading	Mathematics	Science	HDI
Reading	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	188			
Mathematics	Pearson Correlation	.910**	1		
	Sig. (2-tailed)	0			
	N	188	190		
Science	Pearson Correlation	.938**	.945**	1	
	Sig. (2-tailed)	0	0		
	N	188	190	190	
HDI	Pearson Correlation	.728**	.741**	.694**	1
	Sig. (2-tailed)	0	0	0	
	N	188	190	190	190

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

Source: Data processed from PISA & HDI

According to the findings, the greater the students' scores in mathematics, science, and reading, the higher the HDI would be. This statement is valid the other way around as well: the higher the HDI is, the higher will pupils score in mathematics, reading and science. These two go hand in hand, given that in order to fund education, resources that can make this possible are needed, as well as the general and governmental choice to do so. Based on table 1, we can conclude upon the relevance education has towards development. Of course, the complete image of the HDI is not entirely related to only the PISA tests' scores. However, education tends to have positive and direct implications in innovation, resources consumption and social well being.

This study examines the potential relationship between the level of a country's achievement of sustainable development goals (as measured by the SDGs Index) and indicators of quality education, such as the mean years of schooling, lifelong learning, the public and business R&D expenditure, the school dropout rate and the number of doctoral graduates. This study's major objective is to determine the extent to which these indicators may impact a country's level of achievement of sustainable development goals.

## 2. Methodology

In order to determine if quality education has a significant and positive impact on the achievement of the sustainable development goals, this article examines the impact of various indicators relevant to the quality of education on the SDGs in EU Member States and Iceland.

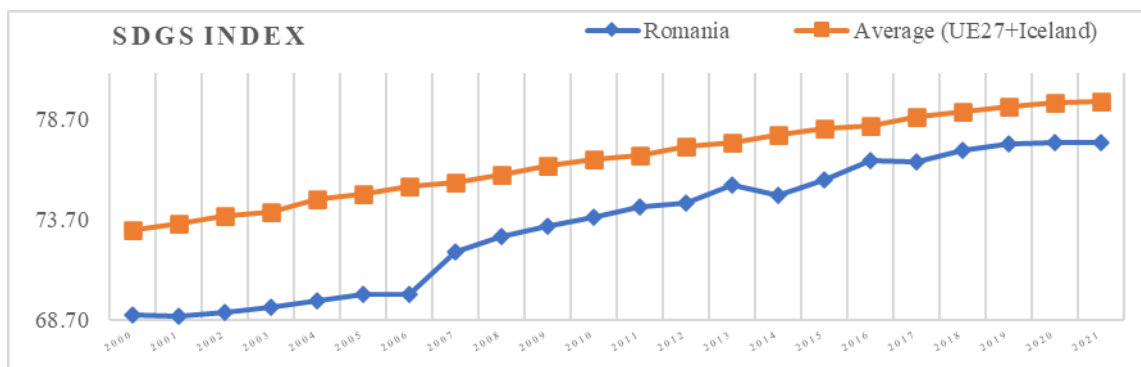
### 2.1. Indicators and data collection

The data comprises of eight indicators gathered from various sources (presented in table 2). The time frame is seven years, from 2015 to 2021, and encompasses 28 nations, including 27 EU members and Iceland. The dependent variable of the subsequent analyses, indicator 1 (Sustainable Development Goals Index) reveals the amount to which the achievement of the sustainable development goals is impacted by the other seven independent factors. The purpose of indicator 2 (Human Development Index) is to illustrate the potential link between development and sustainability. The third through eighth indicators represent the quality of education as well as ways to capitalize on it through research and innovation.

**Table 2. Data collection**

No	Indicator	Source of data
1	Sustainable Development Goals Index	SDG Dashboard
2	Human Development Index	UNDP
3	Mean years of schooling	UNDP
4	Lifelong learning	Eurostat
5	School dropout rate	Eurostat
6	New doctorate graduates	European Commission (Summary Innovation Index)
7	R&D expenditure in the public sector	European Commission (Summary Innovation Index)
8	R&D expenditure in the business sector	European Commission (Summary Innovation Index)

Regarding the values of the SDGs Index from 2000 to 2021 (graph 1), Romania recorded a 12.55 percent growth compared to the UE27+Iceland rise of 8.73 percent. Despite the fact that Romania's value for this indicator was 5.84 percentage points below the UE27+Iceland average in 2000, given the potential stability over time of the average annual growths registered for this indicator, with an annual growth greater by 0.17 percentage points than the UE27+Iceland average, it is anticipated that Romania will close the gap of 2.54 percentage points within 16 years (data processed from [SDGs Index](#)).



**Graph 1: SDGs Index dynamics and evolution over time**

Source: The authors' processing based on data from <https://dashboards.sdgindex.org/map>

Sustainable development is achievable through individuals' efforts and initiatives. The more educated an individual is, the more chances there are that the SDGs can be accomplished. A country's human capital can be enriched qualitatively through the population's participation in educational processes to a greater extent. A primary indicator that precisely reflects this statement is the rate of school dropout. It outlines the percentage of the population aged 18 to 24 years with an elementary (low) level of education that is not attending any form of training/education. A low level of education is considered to be at most primary school. From the point of view of sustainability, this indicator also reflects 1) the population that is at a higher risk of poverty, of social exclusion, marginalization and 2) the quality of the educational system. Therefore, its importance is outlined with regards to the degree by which the SDGs are achievable.

Furthermore, the rate of school dropout for individuals aged 18 to 24 years can have a negative impact on both the mean years of schooling and the expected years of schooling. Mean years of schooling is an indicator that shows the average number of completed years of education by individuals aged 25 or older, whereas the expected years of schooling indicates the number of years a child of 2 years or younger might expect to accomplish if the social patterns are respected. As a consequence, the lower the rate of school dropout, the higher the number of years of completed education for adults will be. Therefore, a possible solution for diminishing the rate of school dropout is the expenditure on education, which in turn will positively influence the two indicators above. A higher number of years of education can prove to be beneficial in order to accomplish the SDGs. Given the relationship between the attained educational level and income, the percentages of individuals at risk of poverty and hunger will diminish as a consequence. Furthermore, lowering the number of adults that have attained only a primary level of education due to school dropout, a positive impact can be expected to indicators such as lifelong learning, digitalization, economic growth and so forth.

As a means to reach the 2030 sustainability targets, lifelong learning represents an additional solution. In our study, this concept is materialized by the degree of participation in educational or training processes of people aged 25 to 64, as a percentage of the total population aged 25 to 64. The positive implications it has towards sustainability reside in the fact that lifelong learning is: a means to the knowledge based economy, a possibility to adapt with ease to the changes in technology, a determinant of digitalization and to some extent innovation. The rapid changes in technologies and economies demand an answer in kind. This answer can be lifelong learning, given the traits it grants to the individual, such as adaptability, knowledge and awareness of the socio-economic context.

Having outlined the primary elements characteristic to the quality of education in our study, the focus shifts towards indicators depicting the expenditure with research and development activities. Presumably a country's level of human capital presents for the most part only highly educated and trained

individuals, then the degree of innovative possibilities is determined by this type of expenditure. In addition to this, a low volume of resources invested in the research & innovation field in a given country, translates to a work domain that is neither attractive nor profitable enough for the young talents. Therefore, the latter shall choose, given the possibility, to invest their time and abilities in a country that presents a better work offer. This in turn leads to accentuated regional discrepancies, as well as investments in education that are not recoverable. Thus, public expenditure with research & development can be directly related, to some extent, to the phenomenon known as *'the mass brain exodus'*.

The expenditure with research and development is reflected, in our study, by the indexes for R&D expenditure both in the public sector and in the business sector. Given that this type of expenditure can be related to employment, the index depicting the newly graduated doctorates is worth taking into consideration. As mentioned above, development implies the existence of innovation and quality education. Thus, an environment that is characterized by investments in research and development offers the optimum conditions where knowledge can thrive. In addition, while the newly doctorate graduates can be considered to incorporate the positive results of education, research and lifelong learning, they can also be considered to represent the future development of the same three aspects. Thus, knowledge is enriched and the sustainable characteristics for development are set.

Although development is reflected by research expenditure and doctorate graduates as well, it might not be sufficient to wholly justify sustainability. The Human Development Index incorporates education, health and standards of living. However, its contribution towards the achievement of the SDGs can have both positive and negative impacts. Although, as mentioned above, education can have only positive outcomes, the standards of living, reflected through consumption mainly, can prove to be one of the negative influences. Given that HDI reflects that standards of living through gross national income per capita, it is correct to assume that it does not entirely take into account other elements specific to the SDGs. Such elements, related to sustainability, can be the environment, the rate of consumption of the nonrenewable resources.

## **2.2. Methods and Results**

The Sustainable Development Goals Index is derived from a composite of 17 sub-indicators. The indicators comprising the fourth objective, quality education, are the participation rate in pre-primary organized learning, the rate of primary education net enrollment, the rate of lower secondary education completion and the literacy rate. This article examines the extent to which measures of quality education have a positive influence on EU Member States' SDG achievement. Thus, the following hypothesis are established:

- 1) The mean years of schooling, lifelong learning and the SDGs Index are positively correlated;
- 2) The public & business R&D expenditure is positively correlated with lifelong learning and the SDGs Index;
- 3) The rate of school dropout negatively affects both the mean years and the SDGs Index;
- 4) A decrease of the school dropout rate has, in counterpart, an increase of the SDGs Index value;
- 5) An increase of the mean years of schooling determines an increase of the SDGs Index value;
- 6) Increments in lifelong learning, doctorate graduates and R&D expenditure positively affect SDGs Index value.

According to table 3, all of the seven indicators are statistically correlated with the SDGs Index. The expenditure with research and development is correlated with the SDGs Index, the HDI, lifelong learning as well as the new doctorate graduates. This depicts an image where sustainable development is achievable through education and its means to innovate. The indicator representing the new doctorate graduates is correlated with the SDGs Index, the HDI and lifelong learning. This strengthens the importance education has towards sustainable development. However, it adds the detail of research expenditure. As mentioned previously in this paper, the investments in education must be met with an equal effort for employability. In order for the investments to begin to produce added value for the economy and towards the sustainability goals, measures for the employment of the young talents are needed.

**Table 3. Correlation analysis**

Correlations		SDGs Index	Human Development Index	Mean Years of Schooling	Life long learning	School dropout rate	New doctorate graduates	R&D expenditure in the public sector	R&D expenditure in the business sector
SDGs Index	Pearson Correlation	1							
	Sig. (2-tailed)								
Human Development Index	Pearson Correlation	.576**	1						
	Sig. (2-tailed)	0							
Mean Years of Schooling	Pearson Correlation	.296**	.380**	1					
	Sig. (2-tailed)	0	0						
Life long learning	Pearson Correlation	.653**	.727**	.267**	1				
	Sig. (2-tailed)	0	0	0					
School drop out rate	Pearson Correlation	-.173*	-0.131	-.279**	0.006	1			
	Sig. (2-tailed)	0.016	0.068	0	0.933				
New doctorate graduates	Pearson Correlation	.685**	.578**	0.087	.563**	-0.12	1		
	Sig. (2-tailed)	0	0	0.226	0	0.094			
R&D expenditure in the public sector	Pearson Correlation	.711**	.657**	.336**	.669**	-.146*	.692**	1	
	Sig. (2-tailed)	0	0	0	0	0.041	0		
R&D expenditure in the business sector	Pearson Correlation	.769**	.686**	.281**	.640**	-0.114	.731**	.766**	1
	Sig. (2-tailed)	0	0	0	0	0.111	0	0	
** Correlation is significant at the 0.01 level (2-tailed).									
* Correlation is significant at the 0.05 level (2-tailed).									

Source: The authors' findings based on the data in Table 2

The school dropout rate is negatively correlated, but with moderate to low intensities, to the SDGs Index and the mean years of schooling. However, given the connection between all of the indicators, it is correct to assume that the rate of school dropout will have a more accentuated impact on the SDGs Index through its additional influences on the other indicators. Nevertheless, the base of sustainability is represented by education and its links to poverty, inequity, digitalization, innovation, consumption.

The SDGs Index and the HDI are positively and highly connected with lifelong learning. This indicates that persons above the age of 25 must enroll in training programs to maintain their technological proficiency. Lifelong learning is responsible, among others, for knowledge sharing, which in turn contributes to the creation of a larger existing data pool. The relationship between lifelong learning and the mean years of schooling can be considered, in this case, to be only at a mathematical level. The greater the number of years the education, the greater the chance the individual will attend part of them at an age of 25 or older. Nevertheless, the mean years of schooling is positively correlated to lifelong learning, which in turn is likewise correlated with the SDGs Index. Judging based on this finding, the higher the mean years of education, the higher the rate of adults participating in educational or training programs and lastly the higher the SDGs Index will.

The Human Development Index is positively and strongly correlated to the SDGs Index. This can imply the fact that education, as a subcomponent of both indexes, has a visible share part in achieving both development and sustainability. Although, as far as this study is concerned, education represents a communality for the two indexes. However, there are substantial differences among them such as the addressing of: poverty, hunger, green energy, natural resources, impact on environment. As far as the indicator depicting the school dropout rate is concerned, it appears to be statistically correlated with other indicators. However, their relationships are of a low intensity. As expected, the volume of expenditure with research and development positively influences the SDGs Index.

The first three hypothesis have been confirmed. The mean years of schooling are statistically correlated with lifelong learning and the SDGs Index. Both public and business research and development expenditures are positively correlated with the SDGs Index and lifelong learning. This type of expenditure is necessary in order to create an environment where innovation can be conducted and knowledge shared. The rate of school dropout has a negative impact on three of the seven indicators. Therefore, a lower rate of school dropout determinates an increase in the SDGs Index, the mean years of schooling and the research expenditure in the public sector.

Further on, given that the correlation between the eight indicators have been established, this study implies a regression analysis. In table 4, the SDGs Index value is the dependent, while the other items mentioned in table 2 are the independents. Therefore, the following analysis will verify hypothesis 4,5 and 6.

**Table 4. Regression analysis**

Regression Statistics	
Multiple R	0.827
R Square	0.684
Adjusted R Square	0.672
Standard Error	1.856
Observations	196

ANOVA					
	df	SS	MS	F	Significance F
Regression	7	1400.049	200.007	58.091	0.000
Residual	188	647.287	3.443		
Total	195	2047.336			

	Coeff.	Std. Err.	t Stat	P-value	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	82.984	4.838	17.151	0.000	73.440	92.529	73.440	92.529
HDI	-13.166	5.744	-2.292	0.023	-24.497	-1.836	-24.497	-1.836
Mean years of schooling	0.241	0.143	1.684	0.094	-0.041	0.524	-0.041	0.524
Life_long_learning	0.111	0.026	4.208	0.000	0.059	0.163	0.059	0.163
School_drop_out	-0.063	0.035	-1.832	0.069	-0.131	0.005	-0.131	0.005
New doctorate graduates	0.017	0.005	3.208	0.002	0.006	0.027	0.006	0.027
R&D expenditure in the public sector	0.010	0.006	1.680	0.095	-0.002	0.023	-0.002	0.023
R&D expenditure in the business sector	0.026	0.005	5.580	0.000	0.017	0.036	0.017	0.036

Source: The authors' findings based on the data in Table 2

Based on the regression analysis presented in table 4, the following formula is obtained:

$$y = \alpha + (-13.166) * x_1 + 0.241 * x_2 + 0.111 * x_3 + (-0.063) * x_4 + 0.017 * x_5 + 0.010 * x_6 + 0.026 * x_7 + \epsilon,$$

where y represents the dependent variable (SDGs Index) and  $x_i, i=1,7$ , represent the seven independent factors.

The R square value of 0.684 points out that the independent variables are responsible for the variation of the SDGs Index by up to 68.4%. Thus, the model presented explains 68.4% of the total data of the 196 observations. The F significance of the regression is less than 0.01 and demonstrates that the model is adequate. The statistically significant coefficient of the HDI suggests that between the SDGs Index and the HDI is a negative relationship. An increase of the HDI value by 1 unit determines a decrease of the SDGs Index by 13.166 units. This might be justified by the fact that the component elements of the HDI do not include the majority of the SDGs Index elements. For example, natural resources and their renewability and CO2 emissions do not address the HDI. While the HDI particularly scores high values for advanced countries, the SDGs Index might register similar scores for countries of different levels of advancement. This is due to the fact that the component elements of the SDGs Index are not so strongly interconnected as those of the HDI. The second independent variable has a positive impact towards SDGs. An increase of the mean years of schooling by 1 year leads to an increase of the SDGs Index by 0.241. Although, in this case, the statistical analysis does not appear to influence the value of SDGs Index by a substantial amount, it is worth considering the adjacent implication of this indicator. As the mean years of schooling increases, so does the rate of adults participating in training programs, the number of newly graduated doctorates and so do the possibilities for innovation. It is correct to assume that these indicators have an influence on the SDGs Index, as well as between themselves.

An increase in the percentage of adults participating in training programs by 1 percentage leads to an increase of the SDGs Index value by 0.111. This indicator's impact can be more significant, as long as the education and training attended imply digitalization and the use of technology. Although the influence is modest, it is worth mentioning that lifelong learning can be a solution for the achievement of the SDGs, through its indirect implications in employment, digitalization and knowledge sharing.

A decrement of 1 percentage in the rate of school dropout has a modest influence towards the achievement of the SDGs. The value of -.063 suggests that, from a statistical point of view, this indicator has little to no impact towards the accomplishment of the SDGs. However, on the long term, the decreasing rate of school dropout is expected to have positive impact on poverty, hunger, unemployment, digitalization. Lastly, the hypothesis 4 was confirmed, given the coefficient's value of

-0.063 for the rate of school dropout. This coefficient can be considered to be even higher, bearing in mind the additional positive implication this indicator has on other relevant indicators such as: the mean years of schooling, lifelong learning, digitalization, etc. Hypothesis 5 was also confirmed. The positive impact mean years of schooling has towards the SDGs Index is outlined by the positive coefficient's value of 0.241. Therefore, a direct and positive outcome can be expected towards the achievement of the SDGs by increasing the average number of years the population has attended. In addition, with a higher average of education years come various implication in other areas, such as innovation, employment, digitalization, etc. The last 3 indicators, outlining innovation and research have been shown to positively influence the SDGs Index, but to a minimal extent. The coefficients of 0.01 to 0.026 depict the image that the SDGs Index is hardly influenced by these three indicators. However, innovation and research are fields that require time for their outcomes to materialize.

### 3. Conclusions

The relevance of lifelong learning and the school dropout rate is emphasized in the context of sustainable development as a central aim achievable via educational and innovative means. The statistical analysis performed in this study reveal the correlation between the selected metrics. Indicators such as mean years of schooling, lifelong learning, the rate of school dropouts and the number of new PhD graduates illustrate the contribution of quality education to the accomplishment of the sustainable development goals. In addition, in order to have a clearer picture of how education positively affects the SDGs Index, this article incorporates additional variables, such as the Human Development Index and R&D expenditure. As the purpose of this study was to emphasize the role of education in achieving sustainable development, these two metrics provide further information, since the contributions of education must shift from a singular focus on development to one on sustainable development. This transition is possible due to the technological, digital, and creative educational opportunities available.

This study has confirmed the predetermined objectives and hypothesis. Consequently, it is observable that the skills of students in disciplines such as mathematics, reading and science are highly and positively correlated with development. In contrast, according to this research, development via education is a notion whose materialization consists of the junction between investments in education and research and the engagement of young talent on the national labor market. As previously stated, as long as expenditures in education are not matched by an equivalent interest in hiring freshly graduated workers, the influence of quality education on achieving the SDGs is diminished. A country's degree of development is reflected, among other things, by its level of digitization. This is a goal whose achievement is strongly tied to lifelong learning. This is demonstrated by the involvement of adults in educational and training programs. Due to technological advancements and the necessity for digitalized processes, there is an increased demand for individuals who can successfully adapt to these changes.

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