Methodology for Assessing and Predicting the Rate of Development of Education in the Republic of Azerbaijan

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Abstract: - The article developed a methodology for assessing the rates of development of education and their forecasting in the Republic of Azerbaijan, which allows considering factors with a heterogeneous metric. For this, an index analysis of thirty-five indicators was carried out, divided into seven groups depending on the level of education, an integral indicator characterizing their changes was calculated, and the pace of development of the industry in the Republic of Azerbaijan was determined. Further, using the Excel program, a forecast of changes in the number of students in the Republic of Azerbaijan until 2023 is presented according to three scenarios: optimistic, probabilistic and pessimistic. Studies have shown that optimistic and pessimistic scenarios are more likely to be realized.

Key-Words: - Forecasting, education, development, assessment methodology, integral indicator.

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1 Introduction

The modern education system occupies an important place in the socio-economic development of any country and is viewed as a condition and prerequisite for raising the material and cultural level of its inhabitants. This industry is characterized by a continuity of levels, which makes it difficult to analyze a multicomponent system and requires taking into account the influence of many factors.

After gaining independence from the former Soviet Union in 1991, the Republic of Azerbaijan gained the opportunity to develop a national education system and scientific and educational ties with various states. In the country there is a growing trend to increase import and export of educational services [3], the role of education in human capital development [4].

The purpose of the article is based on statistical analysis with time-homogeneous metric to develop a method to assess the rate of development of education in the Republic of Azerbaijan and present high-quality predictable result of changes in the number of students to justify effective scenarios.

As research methods used: correlation and regression analysis, index, calculation of the integral indicator, forecasting.

Analyzing foreign publications over the past five years, Hilty, L.[6], Lee, R. [8], Njos, R. [12], Yoon, D. [16], the authors came to the conclusion that the research technologies used in them are based only on analysis, which does not allow forecasting. And in the works of Dede, Y. [1], Gungor, A. [5], Kurniadi, E. [7], Lennert, J. [9], Mehdi, F. [11], Velozo de Castro, E. [15], despite the construction of mathematical models, the approach for accounting for indicators with different units of measurement is not taken into account.

However, based on the technology of assessing the impact of socio-economic factors on the reproduction of human resources in agriculture [13], [14], we managed to develop a methodology for assessing the pace of education development in the Republic of Azerbaijan.

2 Materials and Methods

At the initial stage, a sample of the most significant thirty-five indicators was formed to assess the rate of development of education in the Republic of Azerbaijan (Table 1).

Table 1. Main indicators characterizing the rate of development of education in the Republic of Azerbaijan in 2011-2020 (for the beginning of the year).

Indicators	Years									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Preschool educational institutions										

Number of institutions (units)	1638	1666	1677	1680	1706	1722	1750	1785	1803	1840
Number of seats (thousand units)	128,6	127,2	128,9	121,3	129,9	130,2	134,8	140,6	143,3	146,2
Number of children (thousand people)	112,9	113,5	111,1	107,7	116,0	117,2	118,7	124,2	126,9	128,8
Daytime general education institutions										
Number of institutions (units)	4516	4508	4505	4475	4462	4452	4438	4439	4433	4431
Number of students (thousand people)	1291,3	1284,9	1289,3	1322,2	1353,3	1461,7	1520,2	1561,9	1616,1	1656,8
Number of teachers (key staff) (thousand people)	163,3	163,4	163,0	160,7	158,1	156,9	155,8	154,8	153,0	153,2
The number of children attending training groups in institutions (thousand people)	10,5	11,1	12,2	12,4	13,3	12,1	82,2	94,5	98,1	108,3
Vocational educational institutions										
Number of establishments (units)	109	108	108	112	113	113	112	111	111	110
Number of students (thousand people)	27,3	29,0	30,7	29,2	25,4	24,5	23,8	24,0	23,9	23,2
Admission to institutions (thousand people)	15,7	16,5	18,4	16,1	13,2	15,4	15,9	16,6	17,4	17,1
Graduates of institutions (thousand people)	13,0	13,8	15,2	16,7	15,3	15,2	15,1	14,6	15,5	15,5
Number of teachers (thousand people)	2,0	1,9	1,8	1,8	1,7	1,7	1,7	1,6	1,6	1,5
Secondary specialized educational institutions										
Number of establishments (units)	59	59	58	61	61	55	55	56	59	61
Number of students (thousand people)	54,5	56,0	63,3	60,5	56,4	51,7	47,4	51,7	56,0	60,0
Number of accepted students (thousand people)	16,8	18,9	21,3	14,3	13,8	15,1	15,5	18,0	18,9	19,2
Number of graduates (thousand people)	14,7	15,9	12,6	14,8	16,4	17,1	16,3	12,4	12,4	14,0
Number of teaching staff (key staff) (thousand people)	6,6	6,3	6,1	6,0	6,1	6,1	5,7	5,7	6,1	6,1
Correspondence (evening) educational institutions										
Number of institutions (units)	7	7	7	7	7	7	7	7	7	n / a
Number of students (thousand people)	2,7	2,7	3,0	2,8	2,8	2,5	2,0	1,5	1,0	n / a
Number of teachers (without deputy) (thousand people)	0,22	0,19	0,22	0,20	0,17	0,17	0,15	0,15	0,10	n / a
Higher education institutions										
Number of establishments (units)	51	52	52	53	54	51	51	52	52	52
Number of students (thousand people)	143,1	145,6	151,3	158,2	161,2	163,8	167,7	176,7	187,7	198,7
Number of accepted students (thousand people)	31,2	33,3	35,4	35,8	33,6	36,1	38,5	42,1	44,3	45,0
Number of graduates (thousand people)	30,8	35,1	33,8	32,8	33,7	37,0	37,5	37,1	37,6	40,8

Of the total number of graduates who received a bachelor's degree (thousand people)	27,4	31,5	30,4	28,9	29,0	31,1	32,5	31,7	31,5	34,7
Of the total number of graduates who received a master's degree (thousand people)	3,4	3,6	3,4	3,9	4,7	5,8	5,0	5,4	6,1	6,1
Number of teaching staff (key staff) (thousand people)	14,7	15,1	15,2	15,0	14,6	14,5	14,6	14,8	15,1	15,2
Doctorate										
Number of institutions offering doctoral studies (units)	103	103	106	116	111	110	117	119	119	117
The number of people trained in the PhD program (people)	897	1601	2070	2400	2282	2182	2168	2064	2239	2512
Admission to study under the PhD program (people)	677	814	625	629	558	420	455	665	633	552
Graduates of the PhD training program (people)	396	232	131	277	636	543	529	605	421	356
Number of institutions where doctors of sciences are trained (units)	74	74	74	80	78	80	88	89	90	89
Number of people trained under the doctoral training program (people)	185	411	426	535	593	541	555	562	611	675
Admission to the Doctors of Science Training Program (people)	168	219	134	129	94	101	129	165	140	154
Graduates of the Doctorate of Science Program (people)	10	44	7	50	66	79	69	87	118	84

Source: [14]

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Analyzing the data in Table 1, we will exclude from the list of indicators those that have an insignificant effect on the overall rate of development of education, since they remained almost unchanged for 10 years. This is the number of educational and educational institutions in all blocks, as well as institutions in which training for doctoral programs and the preparation of doctors of sciences is carried out.

The remaining twenty-seven indicators will be reduced to an index value (in% to the previous year) for the possibility of taking them into account when calculating integral indicators (Table 2). The index analysis method makes it possible to aggregate a wide range of quantitative indicators for assessing the rate of development of education, which have different units of measurement and are not comparable without standardization of values. Based on table 1, table 2 is formed, reflecting the index values of indicators characterizing the pace of development of education in the Republic of Azerbaijan in 2011-2020.

Table 2. Dynamics of changes in indicators characterizing the pace of development of education in the Republic of Azerbaijan in 2011-2020, in % to the previous year.

Indicators	Years										Medium pace
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Preschool educational institutions (indices of change)											
Number of seats	103,6	98,9	101,3	94,1	107,1	100,3	103,5	104,3	102,0	102,0	101,7
Number of children	104,6	100,6	97,9	96,9	107,8	101,0	101,2	104,7	102,1	101,5	101,8
Daytime general education institutions (indexes of change)											
Number of students	97,5	99,5	100,3	102,6	102,4	108,0	104,0	102,7	103,5	102,5	102,3
Number of teachers	94,7	100,0	99,8	98,6	98,4	99,2	99,3	99,4	98,8	100,1	98,8

(key staff)											
Number of children attending training groups	105,6	105,9	109,1	102,1	107,0	91,0	679,5	115,0	103,7	110,4	162,9
Vocational education institutions (indices of change)											
Number of students	106,9	106,1	105,8	95,3	86,9	96,3	97,3	100,9	99,8	96,8	99,2
Admission to establishments	116,6	104,9	111,4	87,3	82,3	116,1	103,3	104,8	104,7	98,5	103,0
Graduates of institutions	104,2	106,0	110,6	109,6	91,7	99,3	99,4	96,6	106,0	100,1	102,4
Number of teachers	98,6	95,2	95,7	100,6	93,3	99,3	103,6	94,5	99,8	93,5	97,4
Secondary specialized educational institutions (indices of change)											
Number of students	101,9	102,8	113,1	95,6	93,3	91,6	91,7	109,2	108,2	107,1	101,4
Number of accepted students	106,0	110,4	114,5	67,4	96,6	109,3	102,2	116,1	105,3	101,6	102,9
Number of graduates	100,8	108,2	79,3	117,3	111,3	104,0	95,4	75,8	100,5	112,9	100,5
The number of teaching staff	93,2	94,3	97,4	98,6	101,6	99,5	93,1	101,5	105,6	100,9	98,6
Correspondence (evening) educational institutions (indices of change) *											
Number of students	92,4	100,1	108,9	92,5	100,2	91,8	77,1	75,4	69,8	n / a	89,8
Number of teachers (without deputy)	123,6	87,0	119,3	87,4	88,7	96,0	92,8	94,8	69,2	n / a	95,4
Higher education institutions (indices of change)											
Number of students	102,1	101,7	103,9	104,6	101,9	101,6	102,4	105,4	106,2	105,9	103,6
Number of accepted students	104,4	106,8	106,1	101,2	94,0	107,4	106,7	109,2	105,3	101,5	104,3
Number of graduates	99,2	114,0	96,1	97,2	102,7	109,6	101,5	99,0	101,2	108,7	102,9
Graduates who have received a bachelor's degree out of the total	97,0	114,9	96,3	95,2	100,2	107,4	104,3	97,6	99,2	110,3	102,3
Graduates who have received a master's degree out of the total	121,3	106,7	94,2	115,3	120,7	123,2	86,5	107,6	112,7	100,2	108,8
Number of faculty members (key staff)	98,2	102,9	101,0	98,7	96,9	99,7	100,5	101,4	101,9	101,1	100,2
Doctorate (indices of change)											
The number of people trained in the PhD program	114,1	178,5	129,3	115,9	95,1	95,6	99,4	95,2	108,5	112,2	114,4
Admission to the PhD program	1327,5	120,2	76,8	100,6	88,7	75,3	108,3	146,2	95,2	87,2	222,6
PhD program graduates	87,0	58,6	56,5	211,5	229,6	85,4	97,4	114,4	69,6	84,6	109,4
The number of people trained under the doctoral training program	203,3	222,2	103,6	125,6	110,8	91,2	102,6	101,3	108,7	110,5	128,0
Admission to the Doctors of Science Training Program	1292,3	130,4	61,2	96,3	72,9	107,4	127,7	127,9	84,8	110,0	221,1
Graduates of the Doctors of Science Program	76,9	440,0	15,9	714,3	132,0	119,7	87,3	126,1	135,6	71,2	191,9

Source: Compiled by the authors.

** For 2011-2019.*

Based on the information in Table 2, formula 1 is being developed, which calculates an integral indicator characterizing the pace of development of preschool educational institutions in the Republic of Azerbaijan in 2011-2020 (II_{PE}), in %:

$$II_{PE} = \sqrt[2]{I_{PPE} * I_{CPE}} \quad (1)$$

where I_{PPE} - index of change in the number of places in preschool educational institutions, %;
where I_{CPE} - index of change in the number of children in preschool educational institutions, %.

Analysis II_{PE}, indicates that for 2011-2020 the average value of the indices of change in the number of places and children in preschool educational institutions was almost identical - 101.7 and 101.8%, that is, both had the same effect on the integral indicator.
Further, based on the data in Table 2, formula 2 is developed, which calculates an integral indicator characterizing the pace of development of daytime general education institutions in the Republic of Azerbaijan in 2011-2020 (II_{DGE}), in %:

$$II_{DGE} = \sqrt[3]{I_{PDGE} * I_{TDGE} * I_{TGDGE}} \quad (2)$$

where I_{PDGE} - index of change in the number of pupils of daytime general education institutions, %;
I_{TDGE} - index of change in the number of teachers of daytime general education institutions, %;
I_{TGDGE} - index of change in the number of children attending training groups in daytime educational institutions, %.

II_{DGE}, demonstrates that for the analyzed period, the average value of the indices of change in the number of teachers and children attending training groups in daytime general education institutions ranged from the minimum - 98.8% to the maximum - 162.9%, respectively. Consequently, the last index had the most significant influence on the integral indicator.
Then, based on the materials of Table 2, formula 3 is developed, which calculates an integral indicator characterizing the pace of development of vocational and technical educational institutions in the Republic of Azerbaijan in 2011-2020 (II_{VTE}), in %:

$$II_{VTE} = \sqrt[4]{I_{SVTE} * I_{AVTE} * I_{GVTE} * I_{TVTE}} \quad (3)$$

where I_{SVTE} - index of change in the number of students of vocational and technical educational institutions, %;
I_{AVTE} - index of change in admission to vocational and technical educational institutions, %;
I_{GVTE} - index of change in the number of graduates of vocational and technical educational institutions, %;
I_{TVTE} - index of change in the number of teachers in vocational and technical educational, %.
Analysis of indices of change in indicators II_{VTE}, indicates that for 2011-2020 the average value of two of them tended to decrease (the number of students - 99.2% and the number of teachers - 97.4%), and the other two tended to increase (admission to institutions - 103.0% and graduates of institutions - 102.4%). In sum, they give an average growth of the integral indicator by 2.4%.
Based on table 2, formula 4 is being developed, which calculates an integral indicator characterizing the pace of development of secondary specialized educational institutions in the Republic of Azerbaijan in 2011-2020 (II_{SSE}), in %:

$$II_{SSE} = \sqrt[4]{I_{SSSE} * I_{ASSE} * I_{GSSE} * I_{TSSE}} \quad (4)$$

where I_{SSSE} - index of change in the number of students of secondary specialized educational institutions, %;
I_{ASSE} - index of change of students admitted to secondary specialized educational institutions, %;
I_{GSSE} - index of change in the number of graduates of secondary specialized educational institutions, %;
I_{TSSE} - index of change in the number of teaching staff of secondary specialized educational institutions, %.
II_{SSE} demonstrates that for the analyzed period, the average value of the indices of change in the number of students, admitted students and graduates of secondary specialized educational institutions had a positive trend (all values are above 100.0%). This does not only apply to the index of change in the number of teaching staff, which dropped to 98.6%.
Further, based on the data in Table 2, formula 5 is developed, which calculates an integral indicator characterizing the pace of development of correspondence (evening) educational institutions in the Republic of Azerbaijan in 2011-2019 (II_{CE}), in %:

$$II_{CE} = \sqrt[2]{I_{SCE} * I_{TCE}} \quad (5)$$

where I_{SCE} - index of change in the number of students in correspondence (evening) educational institutions, %;
where I_{TCE} - index of change in the number of teachers in correspondence (evening) educational institutions, %.
Analysis II_{CE}, indicates that for 2011-2020 the average value of both indices tended to decrease. The index of change in the number of students of correspondence (evening) educational institutions decreased to 89.8% (the lowest value among all twenty-eight indicators taken into account when calculating the rate of development of education), and teachers - to 95.4%.
Then, based on the materials of Table 2, formula 6 is developed, which calculates an integral indicator characterizing the pace of development of higher educational institutions in the Republic of Azerbaijan in 2011-2020 (II_{HE}), in %:

$$II_{HE} = \sqrt[6]{I_{SHE} * I_{AHE} * I_{GHE} * I_{BHE} * I_{MHE} * I_{THE}} \quad (6)$$

where I_{SHE} - index of change in the number of students of higher educational institutions, %;
I_{AHE} - index of change in the number of accepted students of higher educational institutions, %;
I_{GHE} - index of change in the number of graduates of higher educational institutions, %;
I_{BHE} - change index of graduates who received a bachelor's degree in higher education, %;
I_{MHE} - change index of graduates who received a master's degree in higher educational institutions, %;
I_{THE} - index of change in the number of teaching staff of higher educational institutions, %.

II_{HE}, demonstrates that during the analyzed period, all average values of the indices had a positive trend and ranged from 100.2% (index of change in the number of teaching staff) to 108.8% (index of change in the number of graduates who received a master's degree). The average rate for all six indicators is 103.7%.
Based on the information in Table 2, formula 7 is being developed, which calculates an integral indicator characterizing the pace of development of doctoral studies in the Republic of Azerbaijan in 2011-2020 (II_{DS}), in %:

$$II_{DS} = \sqrt[6]{I_{CPhD} * I_{APhD} * I_{GPhD} * I_{TDTP} * I_{ADTP} * I_{GDTP}} \quad (7)$$

where I_{CPhD} - index of change in the number of people who completed PhD training, %;
I_{APhD} - the index of change in admission to study under the PhD program, %;
I_{GPhD} - index of change in the number of graduates of the PhD training program, %;
I_{TDTP} - index of change in the number of people trained under the doctoral training program, %;
I_{ADTP} - index of change in admission to the doctoral training program, %;
I_{GDTP} - index of change of graduates of the doctoral training program, %.
Analysis II_{DS} demonstrates that for 2011-2020 the average value of all indices tended to grow, and for three of them almost doubled. These are the indices of change: admission to the PhD program - 222.6%; admission to the doctoral training program - 221.1%; graduates of the doctoral training program - 191.9%. All this testifies to the growing interest in research activities in the Republic of Azerbaijan.
Further, the values of formulas 1-7 are substituted into formula 8 to calculate the integral indicator characterizing the pace of development of education in the Republic of Azerbaijan in 2011-2020 ($II_{D.E.}$), in %:

$$II_{D.E.} = \frac{II_{PE} + II_{DGE} + II_{VTE} + II_{SSE} + II_{CE} + II_{HE} + II_{DS}}{7} \quad (8)$$

where II_{PE} - an integral indicator characterizing the pace of development of preschool educational institutions, %;
II_{DGE} - integral indicator characterizing the pace of development of daytime general education institutions, %;
II_{VTE} - integral indicator characterizing the rate of development of vocational and technical educational institutions, %;
II_{SSE} - integral indicator characterizing the rate of development of secondary specialized educational institutions, %;
II_{CE} - an integral indicator characterizing the pace of development of correspondence (evening) educational institutions, %;
II_{HE} - an integral indicator characterizing the pace of development of higher educational institutions, %;
II_{DS} - an integral indicator characterizing the pace of development of doctoral studies, %.
The values of the integral indicator characterizing the pace of education in the Republic of Azerbaijan in 2011-2020 ($II_{D.E.}$), are entered in

table 3.

Table 3. Integral indicator characterizing the rate of development of education in the Republic of Azerbaijan in 2011-2020, in %.

Indicators	Years										Medium pace
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
II_{PE}	104,1	99,7	99,6	95,5	107,4	100,6	102,4	104,5	102,0	101,8	101,8
II_{DGE}	99,2	101,8	103,0	101,1	102,5	99,1	191,5	105,5	102,0	104,3	111,0
II_{VTE}	106,4	102,9	105,7	97,9	88,5	102,5	100,9	99,1	102,5	97,2	100,4
II_{SSE}	100,4	103,7	100	92,9	100,5	100,9	95,5	99,4	104,9	105,5	100,4
II_{CE}	106,8	93,3	114	90	94,3	93,9	84,6	84,5	69,5	n / a	92,3
II_{HE}	103,4	107,7	99,5	101,8	102,4	107,9	100,1	103,3	104,3	104,6	103,5
II_{DS}	117,7	108,2	62,0	113,4	112,8	139,0	103,1	117,3	144,2	138,8	115,7
$II_{D.E.}$	105,4	102,5	97,7	98,9	101,2	106,3	111,2	101,9	104,2	108,7	103,8

Source: Compiled by the authors.

Analysis of the integral indicator characterizing the pace of education development $II_{D.E.}$, indicates that for 2011-2020 it ranged from 97.7% in 2013 (minimum) up to 111.2% in 2017 (maximum). For eight years out of ten, the indicator was positive. Its average value for 2011-2020 was 103.8%. The most positive influence on it is demonstrated by the integral indicators characterizing the pace of development of doctoral studies (II_{DS}) – 115.7% and day general education institutions (II_{DGE}) – 111.0%. The maximum negative impact in 2011-2019 was exerted (II_{CE}) - an indicator characterizing the pace of development of correspondence (evening) educational institutions (92.3%).

3 Results

At the next stage, in order to further detail the problem under study, we propose to use forecasting tools. To do this, using Excel, we built twenty-seven graphs (for nine indicators in three forecast options: optimistic, probabilistic and pessimistic). Table 4 shows equations for eight indicators of changes in the number of students in the Republic of Azerbaijan, demonstrating the maximum reliability of forecasts for 2021–2023.

Table 4. Forecast of changes in the number of students in the Republic of Azerbaijan until 2023, thousand people

Forecast option	Equation	Year				2023 to 2020,%
		2020	2021	2022	2023	
Number of children in preschool educational institutions						
Optimistic	y = 115,86x2 + 583,25x + 109859	128,8	131,2	133,1	134,6	104,5
Probabilistic	y = 65,235x2 + 1017x + 109210		126,5	130,1	132,0	102,5
Pessimistic	y = 54,777x2 + 1119,1x + 109034		125,8	129,8	131,2	101,9
Number of students in daytime general education institutions						
Optimistic	y = 1637,9x2 + 26803x + 1E+06	1656,8	1710,8	1785,2	1831,4	110,5
Probabilistic	y = 851,47x2 + 34588x + 1E+06		1691,6	1738,1	1784,6	107,7
Pessimistic	y = 42667x + 1E+06		1644,7	1691,3	1739,0	105,0
The number of children attending training groups in educational institutions						
Optimistic	y = 582,54x2 + 5271,1x - 7149,8	108,3	123,0	136,6	150,2	138,6
Probabilistic	y = 372,15x2 + 7162x - 10143		106,9	125,3	137,7	127,2
Pessimistic	y = 93,531x2 + 9683,2x - 14150		90,5	105,4	124,1	114,5
Number of students in vocational education institutions						
Optimistic	y = 30342e-0,028x	23,2	22,8	22,3	21,4	90,5
Probabilistic	y = 30566e-0,03x		22,0	21,3	20,5	88,5
Pessimistic	y = -47,639x2 - 289,5x + 29421		19,5	19,0	18,6	77,6

Number of students in correspondence (evening) educational institutions						
Optimistic	y = -4,294x2 - 135,94x + 3182,8	1,262	1,282	1,051	0,855	67,7
Probabilistic	y = -8,3447x2 - 98,241x + 3120,9		1,047	0,832	0,617	48,9
Pessimistic	y = -11,137x2 - 73,332x + 3081,9		0,845	0,653	0,471	37,3
Number of students of higher educational institutions						
Optimistic	y = 191,67x2 + 3478,1x + 138731	198,7	202,5	208,4	213,3	107,2
Probabilistic	y = 136866e0,0332x		197,2	202,9	208,7	105,0
Pessimistic	y = 138284e0,0308x		192,4	196,9	203,5	102,2
Number of people who completed PhD training						
Optimistic	y = 626,8ln(x) + 1131,2	2,512	2,726	2,809	2,891	115,1
Probabilistic	y = 611,12ln(x) + 1146,6		2,647	2,757	2,867	114,2
Pessimistic	y = 572,74ln(x) + 1185,6		2,531	2,654	2,729	108,6
Number of people trained under the doctoral training program						
Optimistic	y = 218,93ln(x) + 197,9	0,675	0,768	0,810	0,838	124,1
Probabilistic	y = 206,28ln(x) + 210,62		0,726	0,765	0,804	119,2
Pessimistic	y = 192,92ln(x) + 224,17		0,684	0,729	0,758	112,3

Source:- Compiled by the authors.

Based on the three forecast options (Table 4), it can be seen that the indicators of the number of children attending training groups in general educational institutions and the number of people trained under the doctoral program are expected to have a maximum growth (138.6% and 124.1%, respectively, with optimistic forecasts). In general, according to all indicators of Table 4, there is an increase, except for the number of students in vocational schools (a decrease to 77.6%) and the number of students in correspondence (evening) educational institutions (up to 37.3%) with a pessimistic forecast.

4 Discussion

In Figures 1–2, predictive graphs are built for indicators of the number of students in day-time general education institutions and students of higher educational institutions (having the greatest value of the approximation coefficient R2), as having the highest probability of their implementation in the Republic of Azerbaijan until 2023 with an optimistic forecast. So, for the first indicator R2 has a value of 0.9829. Consequently, it is more likely, about 98%, to be realized. And for the second R2 has a maximum value of 0.9862, that is, it will be realized with a 99% probability.

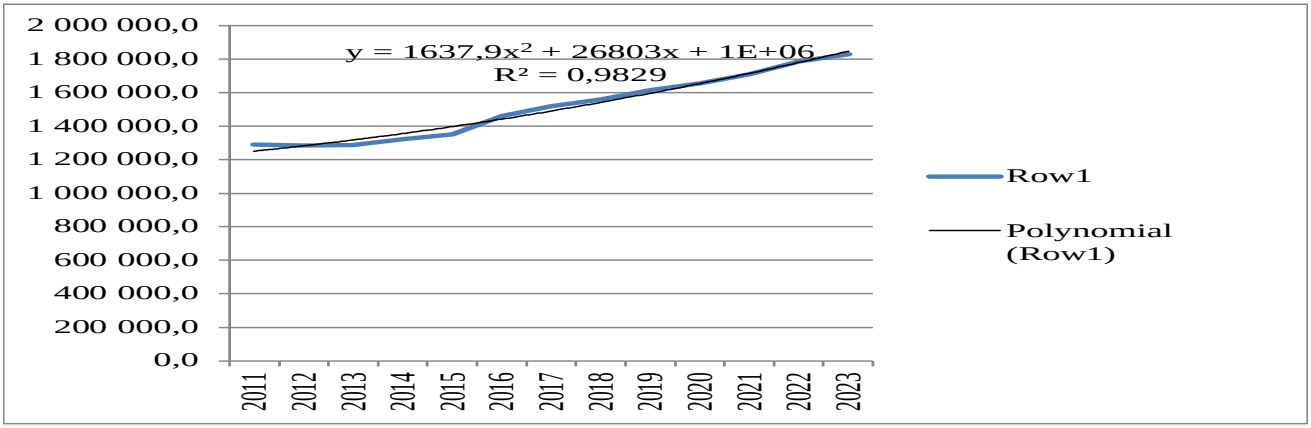

Fig. 1: Optimistic forecast of the number of daytime students educational institutions of the Republic of Azerbaijan until 2023, people
Source: Compiled by the authors.

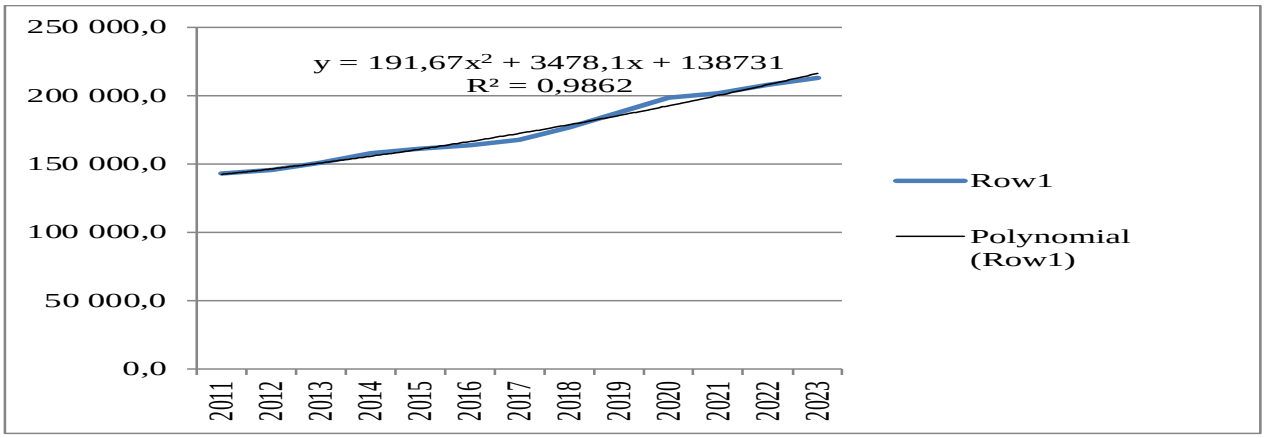

Fig. 2: Optimistic forecast of the number of students higher educational institutions of the Republic of Azerbaijan until 2023, people
Source: Compiled by the authors.

Derivation of the twenty-seven charts involved in writing the article is not possible due to the limited scope of its volume. However, it should be noted that when constructing twenty-four of them, the approximation coefficient R2 turned out to be in the range from 0.8153 (pessimistic forecast of the number of people trained in the PhD program) to 0.9862 (optimistic forecast of the number of students in higher educational institutions). R2 is an indicator of the quality of forecasts: the closer its value is to one, the higher the probability of execution. Moreover, for one half of the forecast options, the approximation coefficient ranges from 0.8153 to 0.8922, and for the other from 0.9112 to 0.9862. This means that the reliability of the calculations performed in twenty-four graphs ranges from 82 to 99%.

5 Conclusions

Thus, the developed methodology is a working tool for determining the rate of development of education in the Republic of Azerbaijan. It is a versatile and accurate forecasting tool for the next period and has great potential for further research. With its help, it is possible to assess not only the impact of certain indicators on the development of education, but also in other sectors and spheres of activity, as well as to assess the impact of any groups of factors in order to ensure sustainable development of the country and its regions.

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