Volodymyr Ponomarenko

# SOME PROBLEMS OF THE EDUCATION SYSTEM IN UKRAINE: ANALYTICS

Monograph

Technology Center

2021

**UDC 371(477)**
**P82**

Published in 2021
by PC TECHNOLOGY CENTER
Shatylova dacha str., 4, Kharkiv, Ukraine, 61165

Approved by the Academic Council of Simon Kuznets Kharkiv National University of Economics, Protocol No. 5 of 30.06.2021

**Reviewers:**
**Galyna Yelnykova**, Doctor of Pedagogical Sciences, Professor, Professor of the Department of Pedagogy, Methods and Management of Education, Ukrainian Engineering Pedagogics Academy;
**Svitlana Kalashnikova**, Doctor of Pedagogical Sciences, Professor, Corresponding Member of the National Academy of Pedagogical Sciences of Ukraine, Adviser to the Directorate of the Institute of Higher Education of the National Academy of Pedagogical Sciences of Ukraine, Member of the National Team of Experts on Higher Education Reform.

**P82** **Authors:**
Edited by **Volodymyr Ponomarenko**
Some problems of the education system in Ukraine: analytics: monograph / V. Ponomarenko. – Kharkiv: PC TECHNOLOGY CENTER, 2021. – 172 p.

The monograph, based on the analysis of statistical data, establishes the wave-like nature of changes in the demographic situation in Ukraine and its periodization. The dependence of the birth rate on changes in GDP is formalized. An assessment of the volume of the educational market and forecasting changes in the contingent of applicants for secondary and higher education. A quantitative analysis of the labor market and the impact of the COVID-19 pandemic on its structure are conducted.
The achievements and shortcomings of the functioning of the system of external independent evaluation of learning outcomes (EIE) in Ukraine are formulated.
The possibilities of using the psychological characteristics of entrants, the scores of their external evaluation certificates to assess future learning outcomes and to assess career prospects after graduation are explored.
A quantitative analysis of the system of financing higher education in Ukraine is conducted. The shortcomings of the current system and ways to eliminate them are substantiated.
Figures 44, Tables 45, References 43 items.



**DOI: 10.15587/978-617-7319-35-0**
**ISBN 978-617-7319-35-0 (online)**
**ISBN 978-617-7319-36-7 (print)**

# AUTHORS


## VOLODYMYR PONOMARENKO

Doctor of Economic Sciences, Professor

Honored Worker of Science and Technology of Ukraine, Cavalier of the Order of Merit, III, II degrees, «Order of Prince Yaroslav the Wise» V degree, corresponding member of the Academy of Pedagogical Sciences of Ukraine

Rector Simon Kuznets Kharkiv National University of Economics

ORCID: https://orcid.org/0000-0002-9702-8469

# ABSTRACT

The monograph, based on the analysis of statistical data, establishes the wave-like nature of changes in the demographic situation and its periodization in Ukraine. The dependence of the birth rate on changes in GDP is formalized. An assessment of the volume of the educational market and forecasting changes in the contingent of applicants for secondary and higher education are evaluated. A quantitative analysis of the labor market in terms of groups of specialties and educational programs, and a quantitative assessment of the compliance of the popularity of entrants in specialties and educational programs to the demands of the labor market are conducted.

It is conducted a quantitative analysis of employers' requirements for candidates for a job, the availability of higher education and work experience. The demand of employers for soft skills job seekers and professional competencies in terms of specialty groups are estimated. The impact of the COVID-19 pandemic on the structure of the labor market is studied.

The clustering of specialties and educational programs by the criterion of similarity of demand for personal and professional competencies is conducted.

The achievements and shortcomings of the functioning of the system of external independent evaluation (EIE) of learning outcomes in Ukraine are formulated.

The possibilities of using the psychological characteristics of entrants, the scores of their EIE certificates to assess future learning outcomes and to assess career prospects after graduation are researched.

A quantitative analysis of the system of financing higher education in Ukraine, including the current system of distribution of budget funds between of higher education institutions is conducted. The shortcomings of the current system and ways to eliminate them are substantiated.

## KEYWORDS

Demography, education, forecast, independent assessment, learning outcomes, IQ, emotional intelligence (EI), labor market.

# CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

## ACKNOWLEDGE

The author is sincerely grateful to colleagues for their help in preparing the materials of the monograph:

– Doctor of Technical Sciences O. Milov for appropriate remarks on certain sections of the monograph;

– Doctor of Economic Sciences L. Malyarets for assistance in processing statistical data;

– Doctor of Economic Sciences V. Tishchenko for assistance in the analysis of the regulatory framework for the taxation of business entities;

– PhD of Pedagogical Sciences G. Polyakova for organizing the survey of students;

– PhD of Economic Sciences S. Golubev for assistance in statistical processing of data on the labor market and psychological characteristics of students.

## CIRCLE OF READERS AND SCOPE OF APPLICATION

The research results presented in this monograph can be useful for graduate students and teachers whose research interests are at the intersection of pedagogy, psychology and economics.

Foreign scholars may be interested in: the results of research on the impact of cognitive and emotional intelligence of Ukrainian students on the results of their studies at the university; dynamics of the demographic situation, characteristics of the labor market and the system of financing higher education in Ukraine.

The monograph can be useful for the management of the Ministry of Education and Science of Ukraine and other departments that have under their HEI jurisdiction. Especially the part of the management that takes care of the quality of training, funding and development of rules for admission to free economic zones.

The results of the study of the dynamics and regional structure of the scores of external evaluation certificates should also be of interest to the management of the regional departments of education and science of Ukraine.

# INTRODUCTION

The processes of progressive globalization and the emergence of the information society characterize the socio-economic transformations of the late XX – early XXI century. They necessitate a change in the paradigm of the higher education system, search for new approaches, technologies, methods of organizing the educational process, criteria for selection of scientific and pedagogical staff forms the basis of innovative autonomous activities of higher education institutions (HEIs), which provides a flexible funding system.

Solving the problem of financing national higher education is becoming increasingly important. The costs of science and education with the right organization will always be highly profitable. In the last century, Nobel Prize – winning economist Simon Kuznets wrote: «The technological development of the past decades rooted in the emergence of modern science is unprecedented, which brings in the question of the encompassing costs on education as a capital investment into national accounting framework» [1].

The education system of Ukraine is currently developing in an environment where there is a significant reduction in the birth rate, which has determined the acceleration of the annual population decline in all age groups. The COVID-19 pandemic, which continues in 2021, has contributed to population decline. In 2020, the number of deaths in Ukraine increased compared to 2019 by 35.7 thousand people [2].

The declining trend in the birth rate, which has been observed since 2014, will have an impact not only on the contingent of freelance students, but also on other quantitative indicators of higher education in Ukraine. Among these indicators are: the number of HEI, the number of teaching staff, the number of places in hostels, the size of the scholarship fund and the salary fund of HEI staff, etc. That is, there is a problem of forecasting the dynamics of quantitative indicators of the education system of Ukraine.

When forming the contingent of applicants for higher education, the problem of assessing the cognitive abilities and potential of young people for self-determination, self-realization and creative activity in a particular field remains relevant.

The functioning of the system of external independent evaluation (EIE) of learning outcomes in Ukraine, along with unconditional positive results, created the problem of insufficient systematization of students' knowledge.

External independent evaluation (EIE) is a standardized test that is mandatory for all graduates of Ukrainian schools who wish to enter HEI in Ukraine, and EIE can be seen as Ukrainian analog of American SAT.

External independent evaluation is conducted in the main subjects of the school course: Ukrainian language and literature, history of Ukraine, mathematics, biology, chemistry, physics, geography, foreign languages.

The test in Ukrainian language and literature is mandatory for all entrants in Ukraine, passing other external evaluation tests is offered to the entrant's choice depending on the specialty chosen by the entrant to study at a HEI.

The problem of quantitative analysis of employers' requirements for job candidates in terms of higher education and work experience, the availability of Soft Skills job seekers and professional competencies in terms of specialty groups needs to be addressed.

This monograph is devoted to the correct formulation and solution of these problems. In the author's opinion, it can be useful for a wide range of research and teaching staff, managers in higher education.

# 1 DYNAMICS OF QUANTITATIVE INDICATORS OF THE EDUCATION SYSTEM OF UKRAINE


## ABSTRACT

The section provides a statistical analysis of the demographic situation in Ukraine and its periodization in accordance with socio-economic indicators. The dependence of the birth rate on changes in GDP is formalized. An assessment of the volume of the educational market and forecasting changes in the contingent of applicants for secondary and higher education. The dynamics of the number of secondary and higher education institutions is studied.



## KEYWORDS

Demography, gross domestic product, education, forecast, pandemic.


### 1.1 CHARACTERISTICS OF THE DEMOGRAPHIC SITUATION IN UKRAINE

The population, its age structure, trends in these indicators affects the quantitative indicators of the entire education system. Moreover, it is impossible to consider the education system in isolation from the economic indicators of the country's development. The development of the country's economy as a socio-economic system in research is characterized by a large number of indicators describing various aspects of its functioning, but in this monograph we will use one of them, which in some sense is integral. This indicator is the size of gross domestic product (GDP). Therefore, we will analyze the dynamics of both demographic indicators and GDP of Ukraine.

It is well known that population changes occur under the influence of two processes: natural and mechanical population movements.

The main indicator of natural movement is the difference between births and deaths, which can be positive (increase) or negative (depopulation). Many Central European countries, including Ukraine, are characterized by depopulation. Ukraine has a strategy of demographic development, within which the material support of families with children has been significantly increased. These measures contributed to some increase in the birth rate, but the general trend remained unchanged. Depopulation is taking place. Factors influencing the indicators of natural movement are studied, in particular, in the work [3].

The hypothesis of some relationship between GDP and birth rate seems natural. Studies have shown that such a relationship between indicators in kind is not statistically significant. However, when using the chain relative indicators born in Ukraine and the corresponding chain relative indicators of GDP in percent, the correlation coefficients indicate the presence of statistical dependence.

Paired Pearson correlation coefficients are as follows $r_{yx} = 0.6023$, $r_{yxl_1} = 0.6432$, $r_{yxl_2} = 0.4404$, $r_{yxl_3} = 0.3376$, where $y$ – the relative chain of births; $x$ – relative chain indicator of GDP; $xl_1$ – lag variable of the relative chain indicator of GDP with a lag of 1 year; $xl_2$ – lag variable of the relative chain indicator of GDP with a lag of 2 years; $xl_3$ – lag variable of the relative chain indicator of GDP with a lag of 3 years.

Correlation coefficients show that the largest relationship is between the change in birth rate and the change in GDP in the one-year period. This means that changes in GDP in a given year have the greatest impact on changes in birth rates in the following year. This statistical relationship is well illustrated by the graphs in **Fig. 1.1**.

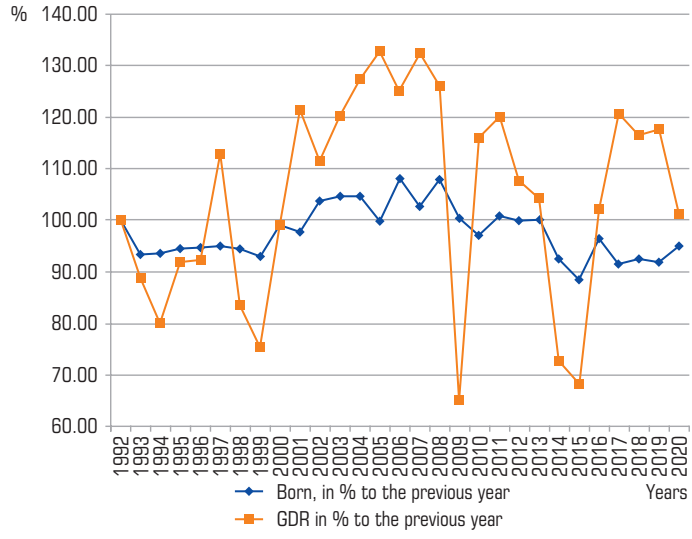



**Fig. 1.1** Chain relative indicators of births in Ukraine and GDP (in %). *Source:* [4–6]

The data in **Table 1.1**, column 2, and **Fig. 1.1** illustrate the dynamics of birth rates in Ukraine from 1990 to 2020.

From 1990 to 2002 we have a reduction in the birth rate by 40 %, in physical terms from 657.2 thousand people to 390.7 thousand people. From 2002 to 2012 there was an increase of 34 %, and in physical terms from 390.7 thousand people in 2002 to 520.7 in 2012.

From 2012 to 2020, there is a steady decline in birth rates by 43 %, and in physical units of reduction from 520.7 thousand people to 293.5 thousand people in 2020.

**Table 1.1** Quantitative indicators of the education system of Ukraine

| Year | Number of live births, thsd | Number of deaths, thsd | Migration growth, thsd, reduction (–) | Children are enrolled in the first grade, thsd | Number of general secondary education institutions, thsd | Number of teachers in general secondary education institutions, thsd | Number of teachers per general secondary education institution | Number of pupils in general secondary education, thsd | Number of pupils per general secondary education institution | Received a certificate of basic general secondary education (graduated from 9th grade), thsd | Received a certificate of completion of general secondary education (graduated from 11th grade), thsd | Number of persons enrolled to study in the HEI (universities, academies, institutes), thsd | Number of persons graduated from the HEI (universities, academies, institutes), thsd | Number of persons in HEI (universities, academies, institutes), thsd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 657.2 | 629.6 | 78.3 | – | 21.8 | 537 | 25 | 7,132 | 327 | 696 | 406.0 | 174.5 | 136.9 | 881.3 |
| 1991 | 630.8 | 669.9 | 151.3 | – | 21.9 | 543 | 25 | 7,102 | 324 | 699 | 409.0 | 173.7 | 137 | 876.2 |
| 1992 | 596.8 | 697.1 | 287.8 | – | 22.0 | 565 | 26 | 7,088 | 322 | 683 | 393.0 | 170.4 | 144.1 | 855.9 |
| 1993 | 557.5 | 741.7 | 54.5 | – | 22.1 | 579 | 26 | 7,096 | 321 | 674 | 375.0 | 170.0 | 153.5 | 829.2 |
| 1994 | 521.6 | 764.7 | –142.9 | – | 22.3 | 576 | 26 | 7,125 | 320 | 654 | 355.0 | 198.0 | 149 | 888.5 |
| 1995 | 492.9 | 792.6 | –131.6 | – | 22.3 | 596 | 27 | 7,143 | 320 | 639 | 361.0 | 206.8 | 147.9 | 922.8 |
| 1996 | 467.2 | 776.7 | –169.2 | – | 22.2 | 585 | 26 | 7,134 | 321 | 657 | 374.0 | 221.5 | 155.7 | 976.9 |
| 1997 | 442.6 | 754.2 | –136.0 | – | 22.1 | 571 | 26 | 7,078 | 320 | 670 | 378.0 | 264.7 | 186.7 | 1,110.0 |
| 1998 | 419.2 | 719.9 | –152.0 | – | 22.1 | 573 | 26 | 6,987 | 316 | 724 | 408.0 | 290.1 | 214.3 | 1,210.3 |
| 1999 | 389.2 | 739.2 | –138.3 | – | 22.2 | 576 | 26 | 6,857 | 309 | 737 | 434.0 | 300.4 | 240.3 | 1,285.4 |
| 2000 | 385.1 | 758.1 | –133.6 | 671.2 | 22.2 | 577 | 26 | 6,764 | 305 | 720 | 475.0 | 346.4 | 273.6 | 1,402.9 |
| 2001 | 376.5 | 746.0 | –152.2 | 599.1 | 22.2 | 568 | 26 | 6,601 | 297 | 738 | 505.0 | 387.1 | 312.8 | 1,548.0 |
| 2002 | 390.7 | 754.9 | –33.8 | 497.3 | 22.1 | 561 | 25 | 6,350 | 287 | 724 | 508.0 | 408.6 | 356.7 | 1,686.9 |
| 2003 | 408.6 | 765.4 | –24.2 | 453.7 | 21.9 | 551 | 25 | 6,044 | 276 | 720 | 526.0 | 432.5 | 416.6 | 1,843.8 |
| 2004 | 427.3 | 761.3 | –7.6 | 422.7 | 21.7 | 547 | 25 | 5,731 | 264 | 675 | 519.0 | 475.2 | 316.2 | 2,026.7 |
| 2005 | 426.1 | 782.0 | 4.6 | 392.6 | 21.6 | 543 | 25 | 5,399 | 250 | 649 | 515.0 | 503.0 | 372.4 | 2,203.8 |
| 2006 | 460.4 | 758.1 | 14.2 | 387.5 | 21.4 | 537 | 25 | 5,120 | 239 | 595 | 485.0 | 507.7 | 413.6 | 2,318.6 |
| 2007 | 472.7 | 762.9 | 16.8 | 380.0 | 21.2 | 531 | 25 | 4,857 | 229 | 561 | 467.0 | 491.2 | 468.4 | 2,372.5 |
| 2008 | 510.6 | 754.5 | 14.9 | 379.4 | 21.0 | 524 | 25 | 4,617 | 220 | 546 | 427.0 | 425.2 | 505.2 | 2,364.5 |
| 2009 | 512.5 | 706.7 | 13.4 | 400.7 | 20.6 | 522 | 25 | 4,495 | 218 | 317 | 391.0 | 370.5 | 527.3 | 2,245.2 |
| 2010 | 497.7 | 698.2 | 16.1 | 408.7 | 20.3 | 515 | 25 | 4,299 | 212 | 566 | 364.0 | 392.0 | 543.7 | 2,129.8 |
| 2011 | 502.6 | 664.6 | 17.1 | 404.2 | 19.9 | 509 | 26 | 4,292 | 216 | 480 | 215.0 | 314.5 | 529.8 | 1,954.8 |
| 2012 | 520.7 | 663.1 | 61.8 | 431.2 | 19.7 | 510 | 26 | 4,222 | 214 | 441 | 329.0 | 341.3 | 520.7 | 1,824.9 |
| 2013 | 503.7 | 662.4 | 31.9 | 451.0 | 19.3 | 508 | 26 | 4,204 | 218 | 411 | 304.0 | 348.0 | 485.1 | 1,723.7 |
| 2014 | 465.9 | 632.3 | 22.6 | 411.6 | 17.6 | 454 | 26 | 3,757 | 213 | 339 | 247.0 | 291.6 | 405.4 | 1,438.0 |
| 2015 | 411.8 | 594.8 | 14.2 | 434.5 | 17.3 | 444 | 26 | 3,783 | 219 | 336 | 229.0 | 259.9 | 374.0 | 1,375.2 |
| 2016 | 397.0 | 583.6 | 10.6 | 424.5 | 16.9 | 438 | 26 | 3,846 | 228 | 329 | 211.0 | 253.2 | 318.7 | 1,369.4 |
| 2017 | 364.0 | 574.1 | 11.0 | 424.7 | 16.2 | 440 | 27 | 3,922 | 242 | 329 | 203.0 | 264.4 | 359.9 | 1,330.0 |
| 2018 | 335.9 | 587.7 | 18.6 | 454.9 | 15.5 | 441 | 28 | 4,042 | 261 | 345 | 195.0 | 256.8 | 357.4 | 1,322.3 |
| 2019 | 308.8 | 581.1 | 21.5 | 434.5 | 15.2 | 440 | 29 | 4,138 | 272 | 352 | 198 | 250.1 | 333.6 | 1,266.5 |
| 2020 | 293.5 | 616.8 | 9.3 | 393.1 | | | | | | | | | | |

*Note: * Calculated by the author based on data* [7–9]

Thus, there are three periods of birth rate change in Ukraine:

– reduction from 1990 to 2002 by 40 % (266.5 thousand people per year (657.2–390.7));

– growth from 2002 to 2012 by 25 % (130 thousand people per year (520.7–390.7));

– reduction from 2012 to 2020 by 22 % (by 257.2 thousand people per year (520.7–293.5 thousand people)).

The second component of the natural population movement is the number of deaths. According to official data [9], we will build a graph of changes in the number of deaths by year (**Fig. 1.2**).

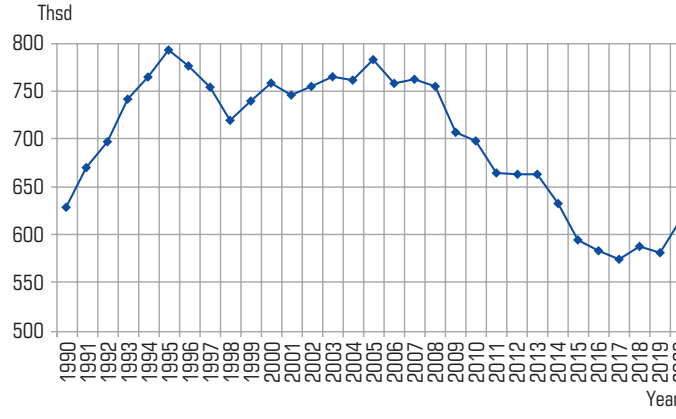



**Fig. 1.2** Dynamics of the number of deaths

In the period from 1990 to 1995, there was a tendency to increase the number of deaths from 629.6 thousand people to 792.6 thousand people, which is an increase of 26 %. In other words, 26 % more people died in 1995 than in 1990.

Then, in the period from 1995 to 1998, the number of deaths decreased annually from 792.6 thousand people to 719.9 thousand people, which is a percentage reduction of 10 %.

In the following period from 1998 to 2005, there was another increase in deaths from 719.9 thousand people to 782.0 thousand people, which is 9 %.

Since 2005, there has been a positive trend of declining mortality, which continues until 2017. During this period, the annual mortality decreased from 782.0 thousand people to 574.1 thousand people, which is a decrease of 37 %.

Since 2017, death rates have been deteriorating again. There is an increase in annual mortality from 574.1 thousand people in 2017 to 616.8 thousand people in 2020. Thus, for three years the growth is 8 %.

One of the indicators that describes demographic processes and is considered the most accurate measure of the birth rate is the total fertility rate (TFR). TFR is the average number of children born to a woman in a hypothetical generation during her lifetime. According to [10], in Ukraine this indicator has been rapidly declining since 1990 (1.56) and reached its minimum in 2001 (1.08); over the next ten years, TFR gradually increased and in 2012 was recorded at 1.53. After that, the decline in this indicator began again. In 2018, it amounted to 1.30, and in 2019, the TFR was equal to 1.228.

In addition to the natural movement of numbers, there is a mechanical movement, which is characterized by migratory changes. If the number of immigrants exceeds the number of emigrants, the migration rate has a positive value. These migration processes are studied in detail by the International Organization for Migration (IOM) in Ukraine [11, 12].

Let's build a graph of migration growth of the population of Ukraine (**Fig. 1.3**).

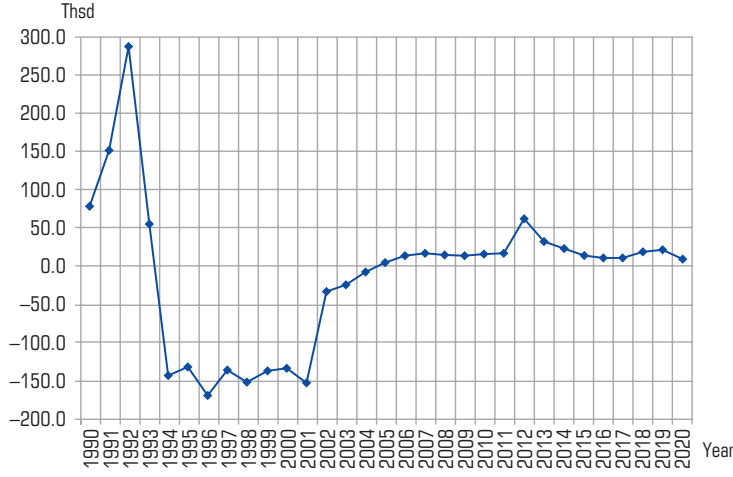



**Fig. 1.3** Migration increase in Ukraine by years, thousand people

The graph illustrates the wave-like migration movement.

From 1990 to 1993, migration growth was positive. Immigrants came to Ukraine in greater numbers than emigrants left. On average, the number of immigrants annually exceeded the number of emigrants 142.98 thousand people.

From 1994 to 2004, migration growth was negative. The number of emigrants was more than the number of immigrants per year by an average of 111.04 thousand people.

From 2005 to 2020, there was a slight excess of the number of immigrants over the number of emigrants (positive migration growth). On average, this difference amounted to 18.67 thousand people annually.

As a result of the unification of natural and mechanical population movements, population dynamics was formed.

Visually more informative was the schedule of chain changes in population on 01.01 each year as a percentage of the previous year, which clearly demonstrates the wave-like «speed» of population changes from 01.01.1990 to 01.01.2020.

The first period is characterized by an increase in the population of Ukraine, adopting from 1990 to 1993 inclusive. The population increased by 405.6 thousand people from 51,838.5 thousand people in 1990 to 52,244.1 thousand people in 1993.

In the second period, from 1994 to 2001, there was a decrease in the population with increasing negative annual chain changes from 52,114.4 thousand people to 48,923.2 thousand people. During this period, the population decreased by 3,191.2 thousand people.

In the third period from 2001 to 2013, the decline continues, but this process is gradually slowing down. This is evidenced by the reduction of negative annual chain changes from –1.02 % to –0.17 %. During this period, the number of population decline amounted to 3,370.2 thousand people (48,923.2–45,533.0).

The fourth period took place from 2013 to 2019, again characterized by an increase in the chain percentage of population decline from –0.17 % to –1.14 %. That is, population decline has accelerated again. The reduction in the 2015 report was particularly noticeable due to the loss of Crimea and parts of the Donetsk and Luhansk regions. During this period, the population decreased by 3,630.6 thousand people, from 45,533.0 thousand persons to 41,902.4 thousand persons.

On the graph (**Fig. 1.4**, data from **Table 1.2**) the percentage of changes –5.5 %, which took place in 2015, was replaced by the value –0.33 %, which was obtained by the approximation procedure, so as not to disturb the visual trend of changes in chain percent.

Thus, over the period under review, the population of Ukraine decreased by 10,468.3 thousand people, from 52,056.6 thousand people in 1992 to 41,588.3 thousand people in 2020, but the decrease was not uniform, and with some wavyness, which is visible on the graph of chain changes, **Fig. 1.4**.

The existing wave-like «rate» of population change is due to the dynamics of natural and mechanical movement of the population, which, in turn, are formed under the influence of socio-economic factors.

That is, the analysis revealed wave-like changes in the demographic situation in Ukraine.

*The first period* (1990–1993) is characterized by a decrease in the birth rate, an increase in the number of deaths, positive migration (more arrivals than departures), and a growing population.

*The second period* (1994–2001) is characterized by a decrease in the birth rate, the number of deaths at the level of 792.6–719.9 thousand people, migration becomes negative (more people leave than they arrive), the population decreases.

*The third period* (2002–2008) is characterized by an increase in birth rates, stabilization of the number of deaths at the level of 754.9–782.0 thousand people per year, migration changes from negative to positive, population decline begins to slow down.

*The fourth period* (2009–2013) is characterized by the stabilization of the annual birth rate at the level of 497.7–520.7 thousand people, the number of deaths decreases from 706.7 thousand people to 662.4 thousand people, continues positive migration, slowing down the decline population is growing.

*The fifth period* (2014–2020) is characterized by a decrease in the annual birth rate from 465.9 thousand people to 293.5 thousand people, the number of deaths decreases except in 2020, when the number of deaths increased compared to 2019 by 35.7 thousand people (possibly due to a pandemic); migration remains positive, the annual population decline is accelerating from –0.27 % in 2014 to –1.14 % in 2019.

Periodization of the demographic situation in Ukraine is summarized in **Table 1.3**.

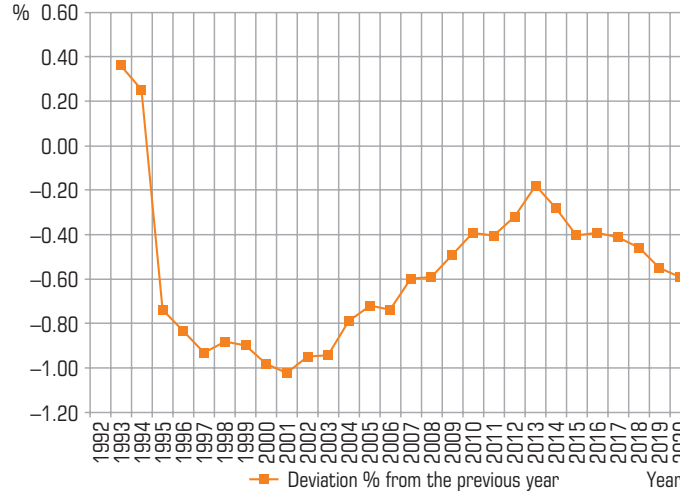



**Fig. 1.4** Graph of chain changes in population each year to the previous one

**Table 1.2** Population estimation indicators

| Year | Population, thsd | Population, in % to the previous year | Deviation % from previous year (chain changes) |
|---|---|---|---|
| 1992 | 52,056.6 | 100.00 | – |
| 1993 | 52,244.1 | 100.36 | 0.36 |
| 1994 | 52,114.4 | 99.75 | 0.25 |
| 1995 | 51,728.4 | 99.26 | –0.74 |
| 1996 | 51,297.1 | 99.17 | –0.83 |
| 1997 | 50,818.4 | 99.07 | –0.93 |
| 1998 | 50,370.8 | 99.12 | –0.88 |
| 1999 | 49,918.1 | 99.10 | –0.90 |
| 2000 | 49,429.8 | 99.02 | –0.98 |
| 2001 | 48,923.2 | 98.98 | –1.02 |
| 2002 | 48,457.1 | 99.05 | –0.95 |
| 2003 | 48,003.5 | 99.06 | –0.94 |
| 2004 | 47,622.4 | 99.21 | –0.79 |
| 2005 | 47,280.8 | 99.28 | –0.72 |
| 2006 | 46,929.5 | 99.26 | –0.74 |
| 2007 | 46,646.0 | 99.40 | –0.60 |
| 2008 | 46,372.7 | 99.41 | –0.59 |
| 2009 | 46,143.7 | 99.51 | –0.49 |
| 2010 | 45,962.9 | 99.61 | –0.39 |
| 2011 | 45,778.5 | 99.60 | –0.40 |
| 2012 | 45,633.6 | 99.68 | –0.32 |
| 2013 | 45,553.0 | 99.82 | –0.18 |
| 2014 | 45,426.2 | 99.72 | –0.28 |
| 2015 | 42,929.3 | 94.50 | –0.40 (–5.5 %) |
| 2016 | 42,760.5 | 99.61 | –0.39 |
| 2017 | 42,584.5 | 99.59 | –0.41 |
| 2018 | 42,386.4 | 99.53 | –0.46 |
| 2019 | 42,153.2 | 99.45 | –0.55 |
| 2020 | 41,902.4 | 99.41 | –0.59 |

**Table 1.3** Periods of changes in the demographic situation in Ukraine

| Indicator / Period | Birth rate | Mortality | Migration | Population |
|---|---|---|---|---|
| 1993–1993 | Reduction of the birth rate. RBR 1.56–1.47 | Increase of mortality | Positive migration | Increases |
| 1994–2001 | Reduction of the birth rate. RBR 1.47–1.08 | Stabilization of mortality (Annually at the level of 792.6–719.9 thsd) | Negative migration | Decreases |
| 2002–2008 | Increase of the birth rate. IBR 1.09–1.39 | Stabilization of mortality (Annually at the level of 754.9–782.0 thsd) | Negative migration changes to positive | Population decline is beginning to slow down |
| 2009–2013 | Stabilization of the birth rate annually at the level 497.7–520.7 thsd SBR 1.21–1.39 | The annual number of deaths decreases from 706.7 to 662.4 thsd | Positive migration | Inhibition of population decline is intensifying |
| 2014–2020 | Significant reduction in birth rate Annually from 465.9 till 293.5 thsd RBR 1.53–1.228 | Mortality reduction, except 2020. (in 2020 – an increase of 35.7 thsd) | Positive migration | Acceleration of annual population decline (from –0.27 % to –1.14 %) |

*Note: ANB is the average number of children born by a woman in a hypothetical generation during her lifetime*

Thus, the education system of Ukraine is currently developing in an environment where there is a significant reduction in the birth rate, which has determined the acceleration of the annual population decline in all age groups. The COVID-19 pandemic, which continues in 2021, has contributed to population decline. In 2020, the number of deaths in Ukraine increased compared to 2019 by 35.7 thousand people.

## 1.2 FORECASTING INDICATORS OF THE EDUCATION SYSTEM OF UKRAINE

Forecasting is a powerful management tool in any socio-economic system. An important component of such systems is the education system, which makes forecasting indicators of its development an important area of management at the micro-, meso- and macro- levels.

The basis of prognostic work is a substantive analysis, without which any formal methods will not be able to give acceptable results. Let's analyze the indicators of the education system.

The wave-like nature of changes in demographic indicators and GDP (see graphs in **Fig. 1.1**) has led to a corresponding feature of the dynamics of indicators of the education system. Their numerical values are presented in **Table 1.1**.

Consider the following indicators:

– children are enrolled in the first grade;

– number of persons received a certificate of basic general secondary education (completed nine classes);

– number of persons received a certificate of completion of general secondary education (completed eleven grades);

– number of persons enrolled to study in the HEIs (universities, academies, institutes);

– number of persons graduated from HEIs (universities, academies, institutes);

– number of persons in general secondary schools;

– number of persons in HEIs (universities, academies, institutes).

Next in the text under the abbreviation HEIs only universities, academies, institutes are meant.

The essence of these indicators determines their fundamental dependence on the birth rate in a given year. Graphic representation of the dynamics of some of these indicators is given in **Fig. 1.5**.

The actual data of these indicators with the corresponding time offsets are presented in **Table 1.4** «Actual and forecast data on the development of the education system of Ukraine».

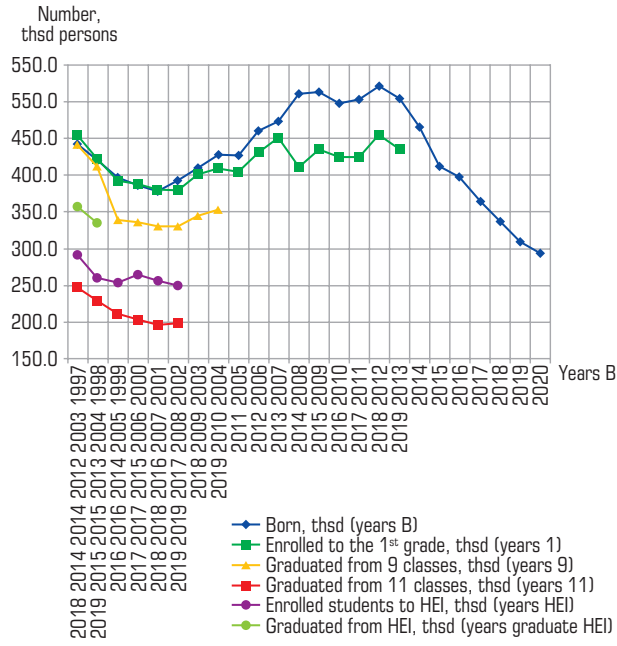



**Fig. 1.5** Dynamics of indicators of education system of Ukraine development

**Table 1.4** Actual and forecast data on the development of the education system of Ukraine

| Born | | Children enrolled to the first grade | | Did not come to the 1st grade | Received a certificate of basic general secondary education (graduated from 9th grade) | | Received a certificate of completion of general secondary education (graduated from 11th grade) | | Number of persons enrolled to study in HEIs | | Number of persons graduated from HEIs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | thsd | Year | thsd | thsd | Year | thsd | Year | thsd | Year | thsd | Year | thsd |
| 1997 | 442.6 | 2003 | 453.7 | –11.1 | 2012 | 441.0 | 2014 | 247.0 | 2014 | 291.6 | 2018 | 357.4 |
| 1998 | 419.2 | 2004 | 422.7 | –3.5 | 2013 | 411.0 | 2015 | 229.0 | 2015 | 259.9 | 2019 | 333.6 |
| 1999 | 389.2 | 2005 | 392.6 | –3.4 | 2014 | 339.0 | 2016 | 211.0 | 2016 | 253.2 | | |
| 2000 | 385.1 | 2006 | 387.5 | –2.4 | 2015 | 336.0 | 2017 | 203.0 | 2017 | 264.4 | | |
| 2001 | 376.5 | 2007 | 380.0 | –3.5 | 2016 | 329.0 | 2018 | 195.0 | 2018 | 256.8 | | |
| 2002 | 390.7 | 2008 | 379.4 | 11.3 | 2017 | 329,0 | 2019 | 198.0 | 2019 | 250.1 | | |
| 2003 | 408.6 | 2009 | 400.7 | 7.9 | 2018 | 345.0 | | | | | | |
| 2004 | 427.3 | 2010 | 408.7 | 18.6 | 2019 | 352.0 | | | | | | |
| 2005 | 426.1 | 2011 | 404.2 | 21.9 | 2020 | 351.0* | | | | | | |
| 2006 | 460.4 | 2012 | 431.2 | 29.2 | 2021 | 378.0* | | | | | | |
| 2007 | 472.7 | 2013 | 451.0 | 21.7 | 2022 | 397.8* | | | | | | |
| 2008 | 510.6 | 2014 | 411.6 | 99 | 2023 | 358.4* | | | | | | |
| 2009 | 512.5 | 2015 | 434.5 | 78 | 2024 | 381.3* | | | | | | |
| 2010 | 497.7 | 2016 | 424.5 | 73.2 | 2025 | 371.3* | | | | | | |
| 2011 | 502.6 | 2017 | 424.7 | 77.9 | 2026 | 371.7* | | | | | | |
| 2012 | 520.7 | 2018 | 454.9 | 65.8 | 2027 | 401.7* | | | | | | |
| 2013 | 503.7 | 2019 | 434.5 | 69.2 | 2028 | 381.3* | | | | | | |
| 2014 | 465.9 | 2020 | 393.1 | 72.8 | 2029 | 339.9* | | | | | | |
| 2015 | 411.8 | 2021 | 339.0* | | | | | | | | | |
| 2016 | 397.0 | 2022 | 324.2* | | | | | | | | | |
| 2017 | 364.0 | 2023 | 291.2* | | | | | | | | | |
| 2018 | 335.9 | 2024 | 263.1* | | | | | | | | | |
| 2019 | 308.8 | 2025 | 236.0* | | | | | | | | | |
| 2020 | 293.5 | 2026 | 220.7* | | | | | | | | | |

*Source:* [13]

Studies have shown that in the conditions of stable development of the state the basic indicator for forecasting the functioning of the educational sector is the number of births. However, in Ukraine in 2014 there were events that led to the loss of Crimea and parts of Donetsk and Luhansk regions. This was the loss not only of part of the territory and economic potential, but also of part of the population, which led to abrupt changes in the demographic situation, which could not but affect the development of the education system. These changes are vividly illustrated by the graphs in **Fig. 1.5**.

The graphical representation of these indicators confirms some similarity of their changes in time at the corresponding shifts on the abscissa axis. In the graphs, the abscissa axis for the indicator «the number of children enrolled to the first grade» has a shift relative to the abscissa axis of the indicator «thousands of people born» for six years. Thus, the first value of the abscissa axis of the indicator «thousands were born» corresponds to 1997, while the first value of the abscissa axis of the indicator «number of children enrolled to the first grade» corresponds to 2003 (1997+6), which is determined by the essence of these indicators.

A comparison of these two indicators according to the abscissa axis of the indicator «the number of children enrolled to the first grade» shows that since 2008 the difference between the number of births and those enrolled to the first grade begins to increase from 11.3 thousand to 21.7 thousand people with small fluctuations over the years. On average over the years, this difference was 18.4 thousand people. Thus, 2,585.8 thousand people were born during this period, and 2,475.2 thousand people went to the first grade of school, which means that 110.6 thousand people remained out of school for six years. The explanation for this fact may be in the plane of migration processes, as mortality has stabilized during this period and therefore can not be a reason to reduce the number of first-graders. See **Table 1.1**, column 3 and **Fig. 1.2**.

In 2014, according to the abscissa axis of the indicator «number of children enrolled to the first grade», the difference between the number of births and those who came to the first grade was 99 thousand people. The explanation for this value is obvious – it is the loss of Crimea and part of Donetsk and Luhansk regions. However, it is necessary to take into account the trend that emerged in the previous period from 2008 to 2013, when the negative impact of migration processes began to be felt. If we take as a constant the number of children who did not come to the first grade due to migration at 18.4 thousand people, then in 2014 the loss of the number of first-graders from the occupied territories will be 80.6 thousand people (99 thousand people – 18.4 thousand people).

In 2015, a significant number of people moved from the occupied territories and sent their children to the first grade in the free territory of Ukraine. Therefore, the difference between the number of births in 2009 and the number of first-graders in 2015 is much smaller than in the previous year and is 78 thousand people. Taking into account the «migration» constant, the loss of first-graders due to the occupation will be equal to 59.6 thousand people (78 thousand people – 18.4 thousand people).

From 2014 to 2020, 2,977.8 thousand people were enrolled to the first grade, while in the period corresponding to the terms of birth from 2008 to 2014, 3,513.7 thousand people were

born. Thus, the education system of Ukraine has not counted 535.9 thousand first-graders in 7 years, or an average of 76.56 thousand people annually.

It should be noted a significant reduction in the number of births in 2015 compared to 2013, which amounted to 91.9 thousand people, due to the occupation of part of the country and the difficult socio-economic situation.

The abscissa axis corresponding to the indicator «the number of students who completed nine grades» starts in 2012, which corresponds to the 2003 abscissa axis of the indicator «the number of children enrolled to the first grade».

The graduation of ninth-graders according to the abscissa axis in 2012 and 2013 differs from the «number of children enrolled to the first grade» by 13 thousand people and 12 thousand people, respectively. Thus, on average, for various reasons, 12.5 thousand people who were enrolled to the first grade each year do not finish nine grades in a given year. However, since 2014, the annual number of students who have not completed nine classes of those who entered the first grade since 2005 has increased significantly and averaged 53.2 thousand annually. Prior to the occupation, an average of 12.5 thousand people did not complete nine classes each year. Thus, the annual loss of ninth grade graduates in the education system of Ukraine due to the occupation is 40.7 thousand people (53.2 thousand people – 12.5 thousand people).

The abscissa axis for the indicators «number of students who have completed eleven grades» and «students enrolled to HEI» starts in 2014, while the abscissa axis for the indicators «number of children enrolled to the first grade» starts in 2003. (2014–2003=11 years).

The difference between the number of children enrolled to the first grade and the number of students who graduated from 11 classes for the period on the abscissa axis for the indicator «the number of students who completed eleven classes» from 2014 to 2019 varies annually from 181.4 thousand persons to 206.7 thousand persons and on the average makes 188.8 thousand persons. This difference includes students who left after the ninth grade to receive higher education and dropped out altogether. Some of those who will receive higher education will enter the Higher Education Institution to receive a full higher education.

The difference between the number of children enrolled to the first grade and the number of students enrolled to the HEIs in the years 2014–2015 on the abscissa axis differs significantly from the difference in 2016–2019. On average for the years 2014–2015 it is 162.45 thousand people, while for 2016–2019 it is 128.8 thousand people. The first period is two years of adaptation to the conditions of hostilities and losses from the occupation. During this period, students who received higher education in the occupied territories did not always have the opportunity to enter the Ukrainian HEI. In addition, educational institutions that have been relocated from the occupied territories have not yet been able to operate at full capacity. Since 2016, the process of admitting children from the occupied territories to Ukrainian HEIs has been established and relocated HEIs have been adapted, so the annual difference between the number of children enrolled to the first grade and the number of students enrolled to HEI has stabilized at 128.8 thousand at 8 %. Let's take 128.8 thousand people as a CB constant for further calculations.

This value is formed under the influence of many factors, among which the most significant are:

– labor migration of parents;

– liberal conditions of admission to some foreign universities (citizens of Ukraine are enrolled not only without control of their level of knowledge, but also without original documents);

– reduction of the number of domestic HEIs;

– increase of requirements to entrants – establishment of the lower limit of competitive points of EIE even for those who enter the contractual form of education;

– increasing the requirements for mastering foreign languages;

– gradual loss of the objective need to obtain higher education for a more or less secure life, especially in the conditions of accessibility of labor migration;

– loss of prestige of higher education.

Analysis of the fluctuation of indicators (**Table 1.4** and **Fig. 1.5**) showed that they are essentially random variables with deterministic components – trends. The mechanism of formation of these random variables determines the leading trend of the indicator «number of births» with a shift along the abscissa by the appropriate value. Thus, the abscissa of the indicator «the number of children enrolled to the first grade» is shifted by six years; indicator «number of students who completed nine classes» – for 15 years; indicators «the number of students who graduated from eleven classes» and «students enrolled to HEIs» – for 17 years.

The choice as a trend of the indicator «number of births» is significantly complicated by sharp changes in other indicators, which are due to these reasons. To predict the number of students who have completed nine grades; the number of students who have completed eleven classes and the number of students enrolled to the HEIs is better to take as a guide the indicator «the number of students enrolled to the first grade» at appropriate intervals. For example, to predict the number of students who will be enrolled to the HEIs in 2020–2024, consider how the values of the indicator «the number of students enrolled to the first grade» changed from 2003 to 2013. We take this period, because during it the socio-economic system of Ukraine developed without drastic changes.

There are several prediction algorithms that can be used in this case. Consider the essence of each of them.

The first is to consider the algorithm of «mean deviations», which is based on the hypothesis that the mean deviations between two random variables do not have significant changes throughout the forecast period. The stability of the difference between the number of children enrolled to the first grade and the number of students enrolled to the HEI over four years allows to formulate a hypothesis about the possibility of sufficiently accurate forecasting.

In this case, the deviation of the number of students enrolled to the first grade in the respective year from the number of students enrolled to the HEIs does not exceed its average value by more than 8 %. We will consider 8 % as a measure of forecasting error according to this algorithm.

For example, the projected value of the indicator of the number of persons enrolled to study in the HEIs in 2020 is equal to the difference between the value of the indicator «students enrolled to the first grade» in 2009 and the CB constant. Thus, the projected value of the indicator «students

enrolled to the HEIs» in 2020 is equal to 271.9 thousand people (400.7 thousand people minus 128.8 thousand people). The results of calculations for the following years are presented in column 4 of **Table 1.5** and on the **Fig. 1.6**.

**Table 1.5** Calculation according to different algorithms of forecast values of the indicator «the number of students admitted to the HEIs»

| Year | Children enrolled to the first grade, thsd | Year of forecast | Forecast of students enrolled to HEIs according to the first algorithm, thsd | Forecast of students enrolled to HEIs according to the second algorithm, thsd | Forecast of students enrolled to HEIs according to the third «extrapolation» algorithm, thsd |
|---|---|---|---|---|---|
| 2009 | 400.7 | 2020 | 271.9 | 258.22 | 262.34 |
| 2010 | 408.7 | 2021 | 279.9 | 267.32 | 273.81 |
| 2011 | 404.2 | 2022 | 275.4 | 281.78 | 289.61 |
| 2012 | 431.2 | 2023 | 302.4 | 302.50 | 309.77 |
| 2013 | 451.0 | 2024 | 322.2 | 326.89 | 334.25 |
| 2014 | 411.6 | 2025 | 282.8 | 280.63 | 363.06 |
| 2015 | 434.5 | 2026 | 305.7 | 298.39 | 346.21 |
| 2016 | 424.5 | 2027 | 295.7 | 308.69 | 433.66 |
| 2017 | 424.7 | 2028 | 295.9 | 311.53 | 475.51 |
| 2018 | 454.9 | 2029 | 326.1 | 306.90 | 521.66 |
| 2019 | 434.5 | 2030 | 305.7 | 294.81 | 572.16 |
| 2020 | 393.1 | 2031 | 264.3 | 275.25 | 626.96 |

The second algorithm is also based on the hypothesis that the mean deviations between two random variables do not have significant changes throughout the forecast period, but with one significant addition.

In the interval 2003–2013, the actual data of the indicator «children enrolled to the first grade» are approximated using the statistical package StatGraphicsCenturion.

We have a polynomial:

$$P1_{(2013)} = 473{,}381 - 31{,}086t + 2{,}68t^2, \quad (1.1)$$

$$R^2 = 0.903,\ F = 37.14,$$

where $t$ takes a value from 1 to 11, which corresponds to the years 2003–2013 abscissa **Fig. 1.5** for the indicator «children admitted to the first grade»; $P1$ – the value of the indicator «children accepted to the first grade».

The model is statistically qualitative according to Fisher's criterion and coefficient of determination.

In the interval 2014–2020 with the help of the same package is an approximation of the actual data of the indicator «children accepted to the first grade».

We have a polynomial:

$$P1_{(2014)} = 384{,}2 + 28{,}961t - 3{,}732t^2, \quad (1.2)$$

$R^2 = 0.525$, $DW = 2.04$.

According to the coefficient of determination and the Darbin-Watson criterion, the model is statistically qualitative.

According to this algorithm, the forecast data of the indicator «students enrolled to the HEI» in the interval 2020–2024 are calculated using polynomial (1.1) in which the free member is reduced by 128.8 thousand people:

$$P1_{(2013)} = 314{,}581 - 31{,}086t + 2{,}68t^2,$$

where $t$ takes the value 7–11, which corresponds to 2020–2024.

In the interval 2025–2031, the forecast data of the indicator «students enrolled to the HEI» are calculated using polynomial (1.2), but the free member of this polynomial is reduced by 128.8 thousand people:

$$P1_{(2014)} = 255{,}4 + 28{,}961t - 3{,}732t^2,$$

where $t$ takes the value 1–7, which corresponds to 2025–2031 years.

The results of calculations by the second algorithm are also presented in **Table 1.5**, but in column 5.

In **Fig. 1.6** the graphic interpretation of forecasting of the indicator «accepted students to HEIs» by the second algorithm is presented.

The third «extrapolation» algorithm is based on the hypothesis that the process described by the actual data and approximated by statistical models does not change over time under the influence of factors that did not act on the interval of obtaining actual data. With the help of the statistical package StatGraphicsCenturion we will approximate the actual data of the indicator «students accepted to the HEI» in the interval 2014–2019.

We have a polynomial:

$$PS_{(2014)} = 303{,}46 - 21{,}049t + 2{,}168t^2, \quad (1.3)$$

$R^2 = 0.69$, $F = 3.34$, $DW = 2.06$,

where $PS$ – the number of students enrolled to the HEIs; $t$ – varies from 1 to 6, which corresponds to the interval 2014–2019, where the approximation process is implemented, and from the values

of *t* from 7 to 11, which corresponds to the time interval from 2020 to 2024, the extrapolation process is implemented. The results of the calculations are presented in **Table 1.5** column 6.

The model is statistically qualitative according to Fisher's criterion, coefficient of determination and Darbin-Watson criterion.

The model has a limit on the time of extrapolation until 2024, because from 2025 on the system of enrollment in the HEI begin to act factors that did not act in the formation of actual data used in the synthesis of the approximation model (1.3). This is a fundamental difference between the third algorithm and the previous two, which take into account the peculiarities of the formation of indicators in the forecasting period.

In **Fig. 1.6** the graphic interpretation of forecasting of the indicator «accepted students to HEIs» by this algorithm is presented.

When using this model to predict the indicator «accepted students to the HEI» outside the interval 2020–2024, its inadequacy seems obvious. See **Table 1.5** column 6 and **Fig. 1.6**.

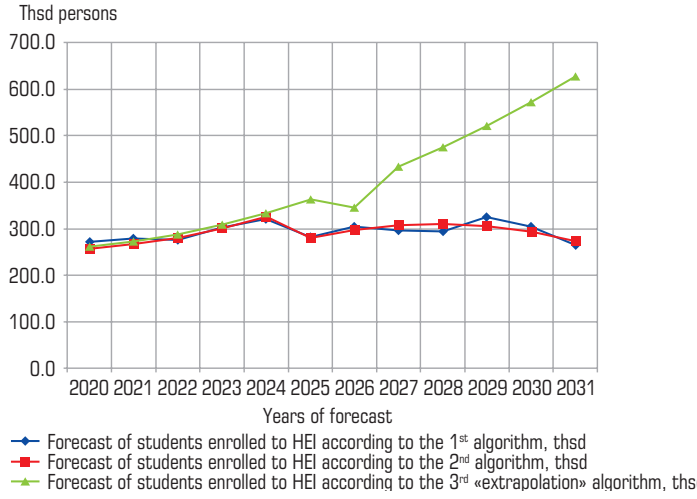



**Fig. 1.6** Graphical interpretation of forecasting the indicator «accepted students to the HEIs» according to three algorithms

The adequacy of forecasting according to the first algorithm («mean deviations») can be approximately estimated by the error of determining the MD constant, which is assumed to be equal to 8 %.

The adequacy of forecasting according to the second algorithm is determined by Fisher's criterion, coefficient of determination, Darbin-Watson criterion and the error of determining the AD constant.

The adequacy of forecasting by the third «extrapolation» algorithm is determined by Fisher's criterion, coefficient of determination, Darbin-Watson criterion. Regarding the scope of this algorithm, it is determined based on the required forecasting horizon, which is limited by the conditions of the accepted hypothesis.

The value of such fundamental indicators of the education system of Ukraine as the number of teachers, the number of secondary school, the number of scientific and pedagogical staff, the number of HEIs, funding for higher and secondary education largely depend on the integrated indicators of the education system of Ukraine, which are the number of students and the number of people in the HEIs.

To predict the dynamics of these integrated indicators, forecasts have already been made until 2031 on the indicator «students enrolled to the HEIs», but this is not enough. It is necessary to make additional forecast calculations until 2026–2031 on the following indicators:

– children are enrolled in the first grade till 2026;

– received a certificate of basic general secondary education (completed nine grades) till 2029;

– received a certificate of completion of general secondary education (completed eleven classes) till 2031;

– the number of persons released from the HEIs till 2031.

Forecasting the number of students enrolled in the first grade will be carried out according to the first algorithm – the algorithm of «average deviations». To calculate the average deviation of the number of births in a given year from the number enrolled to the first class (AD1G), we will take into account the annual actual deviations from 2015 to 2020. The calculation is performed according to **Table 1.1**, column 5. The average deviation of AD1G is 72.8 thousand people. The forecast values of the indicator «Children enrolled in the first grade» for 2021–2026 are given with an asterisk (*) in column 4 of **Table 1.4**. The deviation of 2014 was not taken into account (column 5 of **Table 1.4**). Because this year, as shown above, there was a restructuring of the education system to the conditions of occupation of the Crimea and parts of Donetsk and Luhansk regions.

Forecasting the number of students who received a certificate of basic general secondary education (completed nine classes) is also carried out according to the algorithm of «average deviations». The indicator «Children enrolled in the first grade» is taken as the base and we take its value from 2005 to 2010, which corresponds to 2014–2019 according to the projected indicator. In **Table 1.4**, columns 4 and 7, respectively. The average deviation of the AD9G is 53.2 thousand people. Predicted values are given with an asterisk (*) in **Table 1.4**, column 7.

Forecasting of the indicator «Received a certificate of complete general secondary education» (completed eleven grades) will be carried out according to three algorithms with the basic indicator «Children enrolled in the first grade». First, it is necessary to calculate the average deviation of the indicator projected from the baseline (ADBL). We take the value of the indicator «Children enrolled in the first grade» from 2003 to 2008, which corresponds to 2014–2019 according to the projected indicator. In **Table 1.4**, columns 4 and 9, respectively. The average deviation of ADBL is 188.8 thousand people. Predicted values are given by the first algorithm of «mean deviations» in **Table 1.6**, column 4.

● **Table 1.6** Calculation according to different algorithms of the forecast values of the indicator «Received a certificate of completion of general secondary education» (graduated from eleven grades)

| Year | Children enrolled to the first class, thsd | Year of forecast | Forecast «Number of students who graduated from eleven classes» according to the first algorithm, thsd | Forecast «Number of students who graduated from eleven classes» according to the second algorithm, thsd | Forecast «Number of students who graduated from eleven classes» according to the third «extrapolation» algorithm, thsd |
|---|---|---|---|---|---|
| 2009 | 400.7 | 2020 | 211.9 | 198.22 | 202.5 |
| 2010 | 408.7 | 2021 | 219.9 | 207.32 | 213.07 |
| 2011 | 404.2 | 2022 | 215.4 | 221.78 | 228.82 |
| 2012 | 431.2 | 2023 | 242.4 | 242.50 | 249.72 |
| 2013 | 451.0 | 2024 | 262.2 | 266.89 | 275.82 |
| 2014 | 411.6 | 2025 | 222.8 | 220.63 | 307.10 |
| 2015 | 434.5 | 2026 | 245.7 | 238.39 | 343.56 |
| 2016 | 424.5 | 2027 | 235.7 | 248.69 | 385.19 |
| 2017 | 424.7 | 2028 | 235.9 | 251.53 | 432.00 |
| 2018 | 454.9 | 2029 | 266.1 | 246.90 | 484.00 |
| 2019 | 434.5 | 2030 | 245.7 | 234.81 | 541.16 |
| 2020 | 393.1 | 2031 | 204.3 | 215.25 | 603.51 |

According to the second algorithm, the forecast data of the indicator «Received a certificate of complete secondary education» (graduated from 11 classes) in the interval 2020–2024 are calculated using polynomial (1.1): in which the free member is reduced by 188.8 thousand people:

$$P1_{(2013)} = 284{,}581 - 31{,}086t + 2{,}68t^2,$$

$t$ takes the value 7–11, which corresponds to 2020–2024.

In the interval 2025–2031, the forecast data of the indicator «Received a certificate of complete secondary education» (graduated from 11 classes) are calculated using polynomial (1.2), but the free member of this polynomial is reduced by 188.8 thousand people:

$$P1_{(2013)} = 255{,}4 + 28{,}961t + 3{,}732t^2,$$

where $t$ takes the value 1–7, which corresponds to 2025–2031 years.

The results of calculations according to the second algorithm are presented in column 5 of **Table 1.6**.

The third algorithm for predicting the indicator «Received a certificate of complete secondary education» (graduated from 11 classes) is not tied to the indicator «Children enrolled in the first grade», but is based on the model obtained by approximating the actual data for 2014–2019.

Using the above package, synthesized polynomial:

$$Z11_{(2014)} = 273{,}5 - 28{,}268t + 2{,}589t^2, \quad (1.4)$$

$$R^2 = 0.995,\ F = 302.2,$$

where Z11 – «Received a certificate of complete secondary education» (graduated from 11 grades); $t$ varies from 1 to 6, which corresponds to the interval 2014–2019, where the approximation process is implemented, and from the values of $t$ from 7 to 11, which corresponds to the time interval from 2020 to 2024, the extrapolation process is implemented.

The model is statistically qualitative according to Fisher's criterion and coefficient of determination.

Forecast data are presented in column 6, **Table 1.6**.

The model has a limitation on the time of extrapolation until 2024, because from 2025 the education system of Ukraine will be affected by factors that did not act in the formation of actual data used in the synthesis of the approximation model (1.4). When using this model to predict the indicator «Received a certificate of complete secondary education» (graduated from 11 classes) outside the interval 2020–2024, its inadequacy seems obvious. See **Table 1.6**, column 6 and **Fig. 1.7**.

The movement of the contingent of secondary school learner is schematically presented in the **Fig. 1.8**, and the relationship of variables that determine this movement – in **Fig. 1.9**.

These abbreviations are used:

– $E1G(t)$ – enrolled children in the first grade in a given year;

– $C9G(t)$ – received a certificate of basic general secondary education (completed 9 classes);

– $C11G(t)$ – received a certificate of completion of general secondary education (completed 11 classes);

– $CE10(t)$ – continued education in 10$^{th}$ grade;

– $CBC$ is a constant that characterizes the number of learners who for various reasons dropped out of any class of secondary school during the year. Its size is calculated according to column 8, **Table 1.7**.

Thus, the contingent of learners of secondary school increases by the number of children enrolled in the first grade, the number of children who continued their education in the 10$^{th}$ grade after receiving a certificate of basic general secondary education annually. The decrease in the contingent is due to the number of children who received a certificate of basic general secondary education (graduated from 9$^{th}$ grade), children who received a certificate of complete general secondary education (graduated from 11$^{th}$ grade) and students who dropped out of school any grades of secondary school during the year for various reasons.

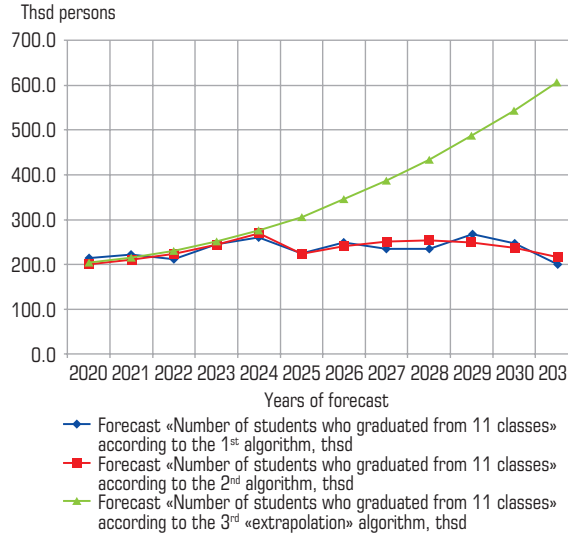



**Fig. 1.7** Graphic interpretation of the forecast of the indicator «Received a certificate of completion of general secondary education» (completed eleven classes) according to three algorithms

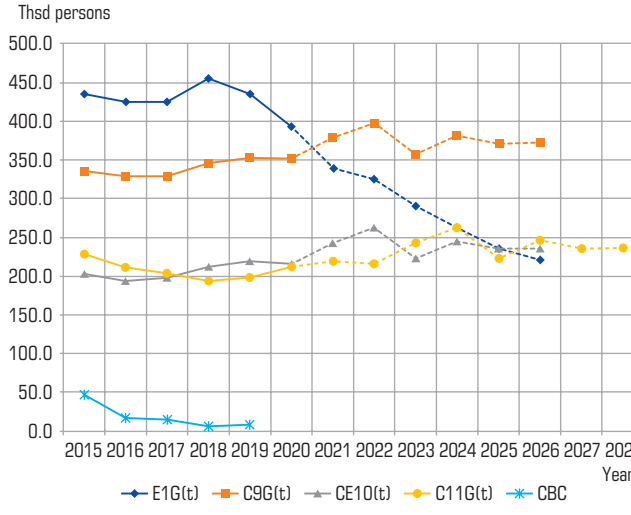



**Fig. 1.8** Diagram of the movement of the contingent of secondary schools

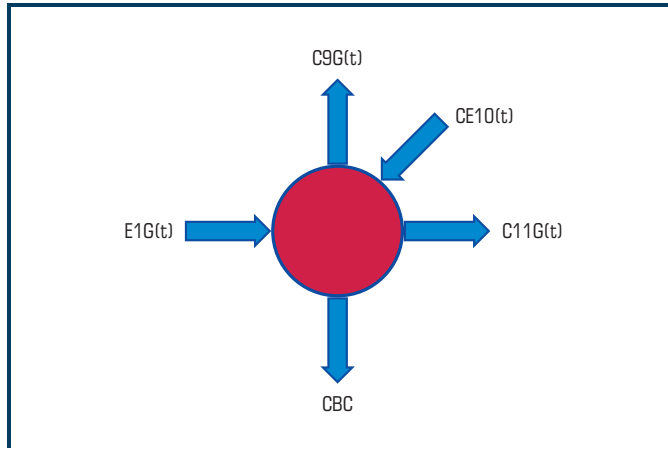



**Fig. 1.9** The relationship of variables that determine the movement of the contingent of secondary school learners

To predict the contingent of secondary school learners, the actual and forecast data are summarized in **Table 1.7**.

Deviation of the estimated number of learners in general secondary school from the actual is given in column 8 of **Table 1.6** from 2015 to 2019. We will not take into account the deviation that took place in 2015, as it was a transitional year in which the education system of Ukraine was adapted to the conditions of alienation of the territory of Crimea and parts of Luhansk and Donetsk regions. Then the average value of CBC will be equal to 11.6 thousand people. This constant is used in the calculations of the projected number of students in general secondary schools for 2020–2026 (column 7, **Table 1.7**). Formula (1.5) is used. The calculated contingent of secondary school learners (column 6, **Table 1.7**) is calculated by the formula:

$$CCO(t)=ACO(t-1)+E1G(t)+CE10(t)-C9G(t)-C11G(t),$$

where $CCO(t)$ – calculated contingent for $t=2015–2019$; $ACO(t-1)$ – the actual contingent of students of secondary school in the previous year; $E1G(t)$ – enrolled children in the first grade in a given year; $C9G(t)$ – received a certificate of basic general secondary education (graduated from 9$^{th}$ grade); $C11G(t)$ – received a certificate of completion of general secondary education (graduated from 11$^{th}$ grade); $CE10(t)$ – continued education in 10$^{th}$ grade.

The projected contingent of secondary school learners ($EC^*$) (column 7, **Table 1.7**) for 2020 is calculated by the formula:

$$EC^*(2020)=AC(2019)+E1G(2020)+CE10(2020)-C9G(2020)-C11G(2020)-CBC.$$

The projected contingent of secondary school learners ($EC^*(t)$ – column 7, **Table 1.7**) for 2021–2026 is calculated by the formula:

$$EC^*(t) = EC^*(t-1) + E1G(t) + CE10(t) - C9G(t) - C11G(t) - CBC. \quad (1.5)$$

According to **Table 1.7** build a graph of the dynamics of the actual contingent of secondary schools from 2005 to 2019 and the forecast for 2020–2026 (**Fig. 1.10**).

In fact, the loss of Crimea and parts of Donetsk and Luhansk regions led to a decrease in the number of secondary schools learners in 2014 by 447 thousand people. From 2015 to 2019, this contingent gradually increased from 3,783 thousand people to 4,138 thousand people. And according to the forecast, in 2020 it will reach its maximum and will amount to 4,172.0 thousand people, which is 32.0 thousand people less than in 2013 before the war. The growth of the secondary schools contingent is mainly due to the increase in the birth rate in 2002–2008. In addition, the growth of the secondary schools contingent is explained by the inclusion in this contingent of children of migrants from the Crimea, Donetsk and Luhansk regions.

● **Table 1.7** Factual and forecast data for determining the forecast number of learners in secondary school (contingent of secondary school)

| Year | Enrolled to the first grade, thsd | Received a certificate of basic general secondary education (graduated from 9th grade), thsd | Continued their education in the 10th grade, thsd | Received a certificate of completion of general secondary education (graduated from 11th grade), thsd | Estimated number of pupils in general secondary education institutions, thsd | Actual and forecasted number of students in general secondary education institutions, thsd | Deviation *CBC(t)*, thsd |
|---|---|---|---|---|---|---|---|
| 2015 | 434.5 | 336.0 | 203.0 | 229.0 | 3,829.5 | 3,783.0 | 46.5 |
| 2016 | 424.5 | 329.0 | 195.0 | 211.0 | 3,862.5 | 3,846.0 | 16.5 |
| 2017 | 424.7 | 329.0 | 198.0 | 203.0 | 3,936.7 | 3,922.0 | 14.7 |
| 2018 | 454.9 | 345.0 | 211.9* | 195.0 | 4,048.8 | 4,042.0 | 6.8 |
| 2019 | 434.5 | 352.0 | 219.9* | 198.0 | 4,146.4 | 4,138.0 | 8.4 |
| 2020 | 393.1 | 351.0* | 215.4* | 211.9* | 4,183.6 | 4,172.0* | |
| 2021 | 339.0* | 378.4* | 242.4* | 219.9* | 4,155.1 | 4,143.5* | |
| 2022 | 324.2* | 397.8* | 262.2* | 215.4* | 4,116.7 | 4,105.1* | |
| 2023 | 291.2* | 358.4* | 222.8* | 242.4* | 4,018.3 | 4,006.7* | |
| 2024 | 263.1* | 381.3* | 245.7* | 262.2* | 3,872.0 | 3,860.4* | |
| 2025 | 236.0* | 371.3* | 235.7* | 222.8* | 3,738.0 | 3,726.4* | |
| 2026 | 220.7* | 371.7* | 235.9* | 245.7* | 3,565.6 | 3,554.0* | |
| 2027 | | | | 235.7* | | | |
| 2028 | | | | 235.9* | | | |

*Source:* [14]

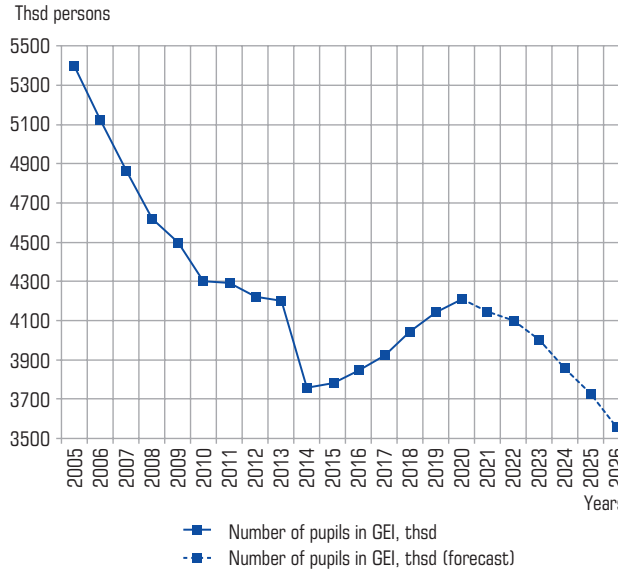



**Fig. 1.10** Graph of the dynamics of change in the contingent of secondary schools for the years from 2005 to 2019 and the forecast for 2020–2026

Based on this contingent of learners, it is necessary to calculate the network of schools and the contingent of teachers.

The dynamics of the actual average occupancy of schools is given in **Table 1.1** (see ninth column). The maximum occupancy rate was observed in 1990 and was 327 learners per school, while the minimum actual occupancy rate was 212 students in 2010. Since 2011, there has been a slight tendency to increase this indicator and as of 2019. its value was 272 learners per school.

According to forecast data, in 2020 the number of learners in secondary schools will reach its maximum and will amount to 4,172.0 thousand children (see **Table 1.7**). In the case of a constant number of schools, the school capacity will average 275 learners per school.

However, if we analyze the structure of school occupancy in terms of regions, cities and villages of Ukraine, the deviations from this average will be significant.

The most tragic situation with the occupancy of schools is observed in rural areas, due to socio-economic factors. The problem of small schools, according to the author, should be solved individually in each case, based on the local situation, and separately for secondary schools I, II and III degrees, due to the difference in age of learners, as well as the necessary staff, methodological and material technical support.

For primary schools that provide primary general education for children aged 6 to 10 (grades 1–4), the place of study should be chosen according to the criterion of maximum proximity to the place of residence of the parents. It should be borne in mind that the logistics of these schools will be less expensive than for primary and secondary schools.

For second grade school that provide basic general secondary education for children 11–15 years (5–9 classes), the main criterion should be staff pedagogical, methodological and logistical support. This is necessary so that the school management has the opportunity to ensure the necessary quality of education and prepare learners to study in specialized vocational schools and to receive a complete general secondary education in third grade school.

The senior school for children of 16–18 years (10–12 classes) with this or that profile should be provided as much as possible both with qualified pedagogical staffs, and the necessary equipment.

Under conditions of significant reduction of the contingent of secondary school learners (**Fig. 1.10**) the system of children's education can be organized according to the following models.

*Model I.* Given the location of the settlements of the district and the number of students in terms of classes, it is necessary to form support schools, where children and teachers will be brought in the morning and taken home in the evening after classes. This model has its own clear interdependent quantitative characteristics:

– the number of children in need of transfer;
– the number of teachers corresponding to the number of learners;
– the total distance that the vehicle must travel;
– the time required to deliver learners and teachers;
– the number of transport units required for the transfer;
– the amount of fuel to ensure the delivery of learners and teachers;
– number of drivers and the number of mechanics who service vehicles;
– the number of medical staff to check the health of drivers before the trip;
– the amount of funds for repair and maintenance of transport;
– the number of other personnel servicing the transport, including managers, engineers and economists.

These quantitative characteristics must be standardized, which requires a professional approach, as any endeavor can be destroyed if the transport system is not balanced. For example, if the number of learners, the distance to be covered, and the number of vehicles are in such a ratio that it takes three hours in the morning to transport children and in the evening the same amount to drive home, then such a system cannot be considered effective because it takes teachers and children travel six hours a day.

*Model II.* For secondary and high school learners, in the case that daily transport services are impossible or economically unreasonable, it is necessary to create weekly boarding schools. Accordance to this model learners should be brought to the boarding school on Monday morning,

and taken home on Friday evening. Under this approach, it is necessary to calculate additional quantitative characteristics:

– the number of beds for children in the hostel;
– the number of seats in the dining room;
– funds for four meals a day for children in the dining room;
– the additional number of teachers to work with children in the afternoon;
– the number of staff serving the hostel.

The internal (boarding school) form of the organization of training theoretically allows to equip as much as possible educational process with technical means, methodical maintenance and qualitative pedagogical staffs. In addition, the independent work of learners in the afternoon can be optionally well organized by teachers in the classroom. Educational work can also be carried out at a high level if desired.

However, this form of organization of the educational process separates children from the family structure, from involving them in housework, from living in the interests of the family and, consequently, socially disorienting children. In addition, this form can leave our villages without young people.

But it should be taken into mind that it is also necessary to give children with innovative abilities the opportunity to actively develop in a creative environment, which can be provided in specialized boarding schools at the high school level.

In addition, it should be borne in mind that secondary schools funding is provided from local budgets, the filling of which will depend on the success of the decentralization reform.

Therefore, when choosing a model, one should take into account the social consequences, which are difficult to quantify, but they can work in a strategic dimension either for the prosperity of the state or for its decline. However, the primacy of the social component in the process of choosing a model does not preclude consideration of the economic criterion, which provides in each case the calculation of these characteristics in order to estimate the cost of a model to make a final decision.

In any case, the reduction of the number of students in secondary schools to the level of approximately 4 million learners and the existence of such a level for ten years leaves no choice but to reduce the number of relevant educational institutions. In such a development, it is necessary to develop the most effective scenario for such a reduction with the choice of the most adequate model.

If we assume that as of 2026 the ratio between learners and teachers will not change and will remain at the level of nine students (9.4) per teacher (value for 2019), then for the future contingent 3,554.0 thousand 378 thousand teachers will be needed, which is 68 thousand teachers less than in 2019. Although according to the Institute of Educational Analytics [15] the workload of teachers in specialized schools, gymnasiums and colleges exceeds 11 students. If we accept the hypothesis that the most qualified teachers work in these secondary schools, we have a banal conclusion – there is a lack of competent professionals. Thus, there is a real problem of training quality teachers in the HEI. It is due primarily to the low attractiveness of pedagogical work, which is formed in Ukraine. Applicants with extremely low competitive scores are accepted for the state form of education in pedagogical specialties, which demonstrates the appropriate level of their cognitive abilities.

The cardinal solution of this problem lies in the plane of methods of formation of the state order and the maintenance of «rules of reception in HEI». A more detailed analysis of the situation will be presented in the following sections of the monograph.

A significant reduction in the number of secondary school learners in 2026 can not but affect the number of these educational institutions. Even with the existing average school capacity of 272 learners in 2019, one school will need 13 thousand schools in the presence of 15.2 thousand in 2019. Obviously, the structure of school reduction should depend on the number of learners in the region, city, village, their topography placement and, of course, the quality of teaching staff.

No less important is the problem of the development of higher education in Ukraine in connection with the development of secondary school. From a formal, quantitative point of view, it is characterized by several indicators. First of all, the ratio of the number of learners who received a certificate of complete general secondary education (graduated from 11$^{th}$ grade) and the number of people enrolled to the HEI education (universities, academies, institutes) is informative. Actual data on these indicators are presented in **Table 1.1**, columns 12, 13, and forecasts are presented in **Tables 1.5** and **1.6**, column 4 (forecasting by the first algorithm). Graphic representation of indicators is given in **Fig. 1.11**.

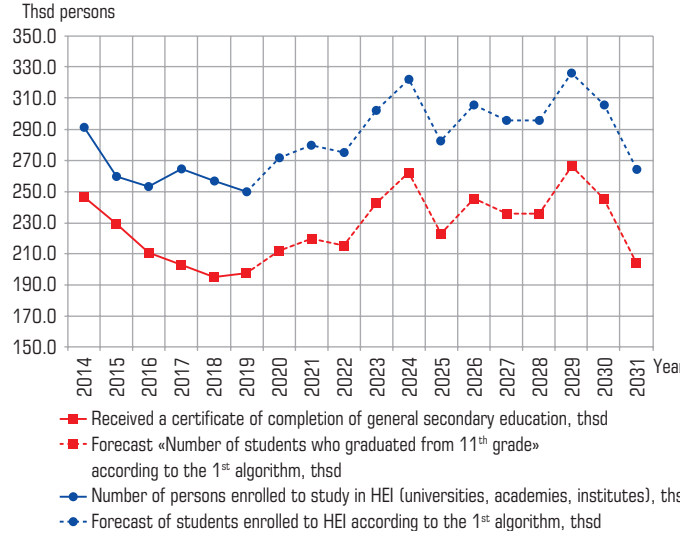



**Fig. 1.11** Graphs of the number of students who received a certificate of completion of general secondary education (graduated from 11$^{th}$ grade) and the number of persons enrolled to study in the HEI

The graphs demonstrate a steady trend of exceeding the number of students enrolled to the HEIs (universities, academies, institutes) over the number of students who received a certificate of secondary education (graduated from 11th grade). This phenomenon is due to the fact that universities, academies, institutes are enrolled en masse by graduates of colleges and technical schools, colleges, for which the rules of admission until recently did not provide for mandatory external independent evaluation.

Thus, those students who first entered colleges and technical schools, vocational school had two significant advantages.

First, they received professional training and could count on skilled work.

Second, they could assess how well a profession suited them.

Third, they avoided the cumbersome procedure of passing EIE for admission to universities, academies, and institutes.

Fourth, they have the opportunity to enroll for a reduced period of study (to obtain a bachelor's degree in 2–3 years).

However, from 2019, the rules of admission to the HEI provide for the need to obtain external evaluation certificates in the Ukrainian language and literature, even for graduates of technical schools, colleges and vocational school. From 2021, it is planned to introduce mandatory external examination in mathematics for them. In addition, a minimum number of competitive points for entrants is set for many specialties (at the level of 130–150 points) and a system of «indicative prices» is introduced for admission to the contractual form of education. This approach in 3–4 years can change the ratio between high school graduates and enrolled in the HEI.

The dynamics of the number of universities, academies, and institutes is characteristic of the development of higher education in Ukraine.

The period from 1994 to 2009 was characterized by a rapid growth in the number of universities, academies, institutes of various forms of ownership. At that time, almost 200 such HEIs were opened, which was due to the phenomenal liberalization of licensing requirements for educational activities in the field of higher education.

In **Table 1.8** the actual data on the number of HEIs by years and chain changes of their number are presented, and in **Fig. 1.12** – their graphic interpretation.

The record number of open higher education institutions is from 1994 to 1996, when 115 of them were opened. This number of new educational institutions easily accepted all those wishing to obtain a diploma of higher education.

Almost everyone wishing to obtain a diploma of higher education could fulfill their desire, regardless of available cognitive abilities. Even the introduction of a mandatory external independent evaluation in 2008 could not stop this process.

Along with the change in the number of universities, academies, and institutes, the contingent of people studying there changed. In **Fig. 1.13** the schedule of average filling of one HEI on years is presented.

**Table 1.8** Dynamics of development of the system of universities, academies, institutes [7]

| Year | Number of universities, academies, institutes | The difference to the previous year | Year | Number of universities, academies, institutes | The difference to the previous year |
|---|---|---|---|---|---|
| 1990/1991 | 149 | 0 | 2005/2006 | 345 | –2 |
| 1991/1992 | 156 | 7 | 2006/2007 | 350 | 5 |
| 1992/1993 | 158 | 2 | 2007/2008 | 351 | 1 |
| 1993/1994 | 159 | 1 | 2008/2009 | 353 | 2 |
| 1994/1995 | 232 | 73 | 2009/2010 | 350 | –3 |
| 1995/1996 | 255 | 23 | 2010/2011 | 349 | –1 |
| 1996/1997 | 274 | 19 | 2011/2012 | 345 | –4 |
| 1997/1998 | 280 | 6 | 2012/2013 | 334 | –11 |
| 1998/1999 | 298 | 18 | 2013/2014 | 325 | –9 |
| 1999/2000 | 313 | 15 | 2014/2015 | 277 | –48 |
| 2000/2001 | 315 | 2 | 2015/2016 | 288 | 11 |
| 2001/2002 | 318 | 3 | 2016/2017 | 287 | –1 |
| 2002/2003 | 330 | 12 | 2017/2018 | 289 | 2 |
| 2003/2004 | 339 | 9 | 2018/2019 | 282 | –7 |
| 2004/2005 | 347 | 8 | 2019/2020 | 281 | –1 |

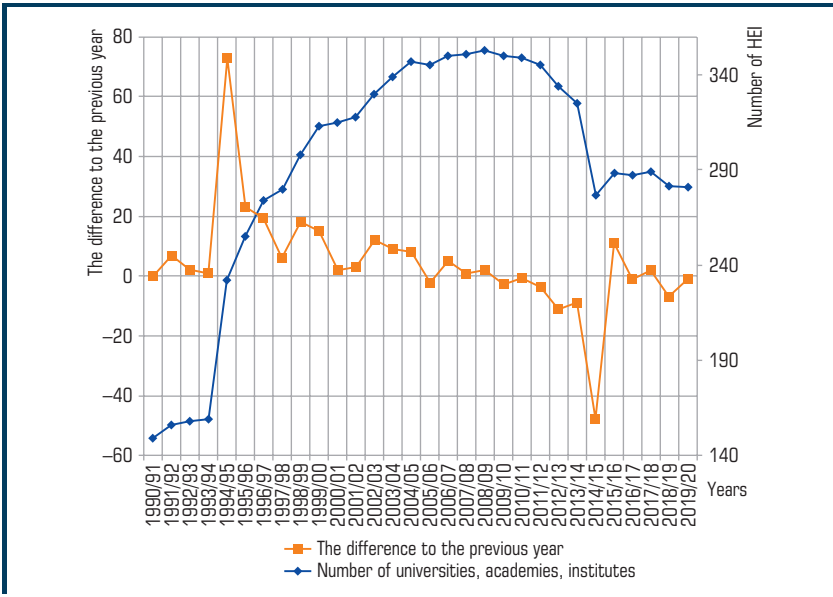



**Fig. 1.12** Dynamics of changes in the number of universities, academies, institutes in Ukraine and chain changes in the number

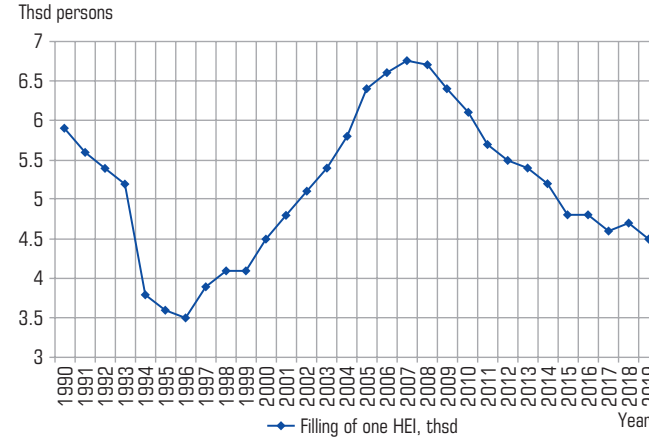



**Fig. 1.13** The schedule of average filling of one HEI on years

Regarding the forecast values of the output from HEI, the calculation was carried out according to the algorithm of «average deviations». To calculate the constant CBB – «the average deviation of the number of persons enrolled to HEIs (universities, academies, institutes) from the number of persons graduated from HEIs (universities, academies, institutes)» was calculated the difference between them in 2014, 2015 and 2018, 2019, respectively. It amounted to 139.5 thousand people. Then the annual constant of CBB is equal to 69.75 thousand people. At first glance, it seems strange that fewer students are enrolled to such HEIs than four years later. However, the explanation for this is in the system of statistical reporting, according to which only persons enrolled in the HEI for the first time belong to those enrolled (without those who continue their studies in order to obtain a higher educational degree (educational qualification level)).

In fact, in addition to these persons, they enter the HEI to obtain a second higher education, to obtain a higher educational degree (educational qualification level) after a break in education, to improve their skills and so on.

The results of the forecast of the number of persons enrolled in the HEIs in the period from 2020 to 2031 using three algorithms are presented in **Table 1.5**, and the actual data in **Table 1.1**, column 13.

Actual data on the number of graduates of universities, academies, institutes are given in **Table 1.1**, column 14, and forecasts are presented in **Table 1.9** in column 3. Actual data on the number of persons studying in the HEIs for the period 2014 to 2019 for column 5, **Table 1.9** are given in column 15 of **Table 1.1**.

Calculated number of persons studying at universities, academies, institutes (HEI contingent) column 4 **Table 1.9** calculated by the formula:

$$CCO(t) = ANP(t-1) + AEP(t) - AGP(t),$$

where $CCO(t)$ – calculated contingent for $t = 2015–2019$; $ANP(t-1)$ – the actual number of persons who studied in the HEIs in the previous year; $AEP(t)$ – actually enrolled in the HEIs in a certain year; $AGP(t)$ – actually graduated persons from the HEIs.

● **Table 1.9** Actual and forecast data to determine the estimated number of persons enrolled in HEI (universities, academies, institutes)

| Year | Enrolled to HEI, thsd (1) | Graduated from HEI, thsd (2) | Calculated contingent, thsd | Actual contingent, thsd | Deviation, thsd |
|---|---|---|---|---|---|
| 2014 | – | – | – | 1,438.00 | – |
| 2015 | 259.90 | 374.00 | 1,323.90 | 1,375.20 | 51.30 |
| 2016 | 253.20 | 318.70 | 1,309.70 | 1,369.40 | 59.70 |
| 2017 | 264.40 | 359.90 | 1,273.90 | 1,330.00 | 56.10 |
| 2018 | 256.80 | 357.40 | 1,229.40 | 1,322.30 | 92.90 |
| 2019 | 250.10 | 333.60 | 1,238.80 | 1,266.10 | 27.30 |
| 2020 | 271.90* | 322.95* | 1,215.05* | 1,272.55* | 57.50 |
| 2021 | 279.90* | 334.15* | 1,218.30* | 1,275.80* | – |
| 2022 | 275.40* | 326.55* | 1,224.65* | 1,282.15* | – |
| 2023 | 302.40* | 319.85* | 1,264.70* | 1,322.20* | – |
| 2024 | 322.20* | 341.65* | 1,302.75* | 1,360.25* | – |
| 2025 | 282.80* | 349.65* | 1,293.40* | 1,350.90* | – |
| 2026 | 305.70* | 345.15* | 1,311.45* | 1,368.95* | – |
| 2027 | 295.70* | 372.15* | 1,289.50* | 1,347.00* | – |
| 2028 | 295.90* | 391.95* | 1,250.95* | 1,308.45* | – |
| 2029 | 326.10* | 352.55* | 1,282.00* | 1,339.50* | – |
| 2030 | 305.70* | 375.45* | 1,269.75* | 1,327.25* | – |
| 2031 | 264.30* | 365.45* | 1,226.10* | 1,283.60* | – |

*Note: (1) – persons first enrolled in the HEI (excluding those who continue their studies in order to obtain a higher educational degree (educational qualification level)); (2) – graduates (excluding persons continuing their studies in order to obtain a higher educational degree (educational qualification level)); (*) – forecast values*

Let's compare the size of the estimated contingent of column 4 with the actual contingent of column 5. The actual contingent in the interval 2015–2019 consistently exceeds the estimated. Thus, the proposed formula underestimates the annual number of people studying at universities, academies, institutes. The annual deviation averages 57.5 thousand people. We take this number as a constant CBB0. The forecast contingent of persons studying in the data of HEI ($PCO^*$) (column 5, **Table 1.9**) for 2020 is calculated by the formula:

$$FCO^*(2020) = ANP(2019) + AEP(2020) - AGP(2020) + CBB0.$$

The forecast contingent of HEIs ($FCO^*(t)$ – column 5, **Table 1.9**) for 2021–2026 is calculated by the formula:

$$FCO^*(t) = FCO^*(t-1) + FPI^*(t) - FPG^*(t) + CBB0,$$

where $FPI^*(t)$ – the forecast number of persons included in the HEIs in a given year; $FPG^*(t)$ – forecast number of persons graduated from the HEIs in a given year. Thus, starting from 2020, there will be an increase in the contingent of HEIs students in Ukraine. This is in line with existing evidence on the number of births since 2002. It is at this time, according to the State Statistics Service, there is a gradual increase in their number. This trend persisted until 2013 (**Fig. 1.14**).

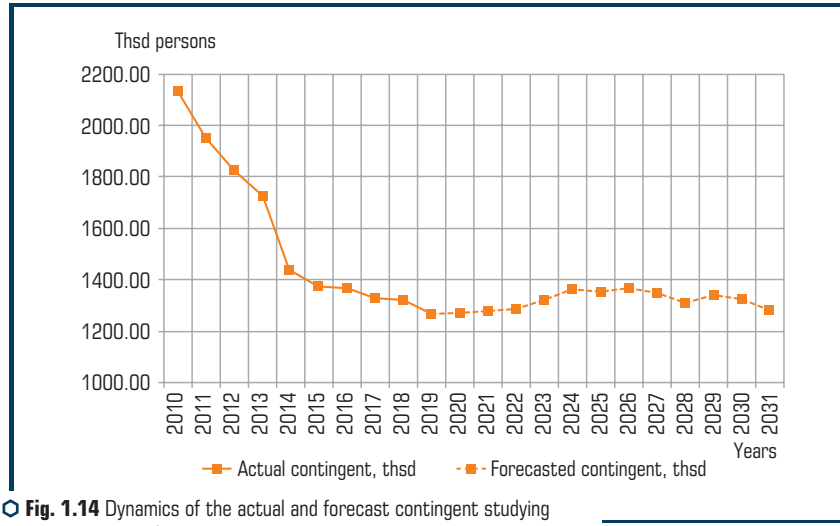



**Fig. 1.14** Dynamics of the actual and forecast contingent studying at universities, academies, institutes

The conducted research can be used as a marketing basis for solving urgent problems of higher education in the process of internal and external management of higher education institutions.

That is, we can conclude that the contingent of HEIs students will tend to increase in the coming years (approximately until 2026), after which there will be a decrease in the contingent.

The declining trend in the birth rate, which has been observed since 2014, will have an impact not only on the HEIs contingent, but also on other quantitative indicators of higher education in Ukraine, including the number of HEIs, the number of teaching staff, the number of places in hostels, the size of the scholarship fund and the salary fund of pedagogical staff, etc. That is, forecasting the dynamics of quantitative indicators of the education system of Ukraine makes it possible to correctly build a strategy for its development.

# 2 ANALYSIS OF THE REGIONAL LABOR MARKET


## ABSTRACT

The section provides a quantitative analysis of the labor market in terms of groups of specialties and educational programs. A quantitative assessment of the compliance of the popularity of entrants in specialties and educational programs to the demands of the labor market.

A quantitative analysis of employers' requirements for candidates for a job, the availability of higher education and work experience. The demand of employers for soft Skills job seekers and professional competencies in terms of specialty groups is estimated by employers. The impact of the COVID-19 pandemic on the structure of the labor market has been studied.

Clustering of specialties and educational programs according to the criterion of similarity of demand for personal and professional competencies.



## KEYWORDS

Higher education, forecast, labor market, competencies.


A large number of works by foreign and domestic scientists is devoted to the analysis of the labor market. Specific methods of valuing this market have been developed within the framework of a certain methodology.

For example, the work [16], which states: «Thus, the suggested methodology for assessing competitiveness in the regional context made it possible to carry out a comprehensive analysis, monitoring and ranking of the regions of Ukraine by the level of competitiveness of young people in the labor market, as well as to determine the priority areas and tasks of development of both regional and state, youth labor market and increase its competitiveness».

Indeed, the results presented in this paper are of some practical interest. However, many problems of youth employment, applicants' choice of specialty when entering the HEI, assessment of the impact of the COVID-19 pandemic on the labor market require further research.

Scientists of Simon Kuznets Kharkiv National University of Economics has been working in this direction for ten years.

The research concerns Kharkiv, Donetsk, Luhansk, Poltava and Sumy regions. The analysis was carried out in relation to the list of specialties, educational programs for which the training of specialists with higher education is carried out at Simon Kuznets Kharkiv National University of Economics in comparison with the data for Ukraine as a whole.

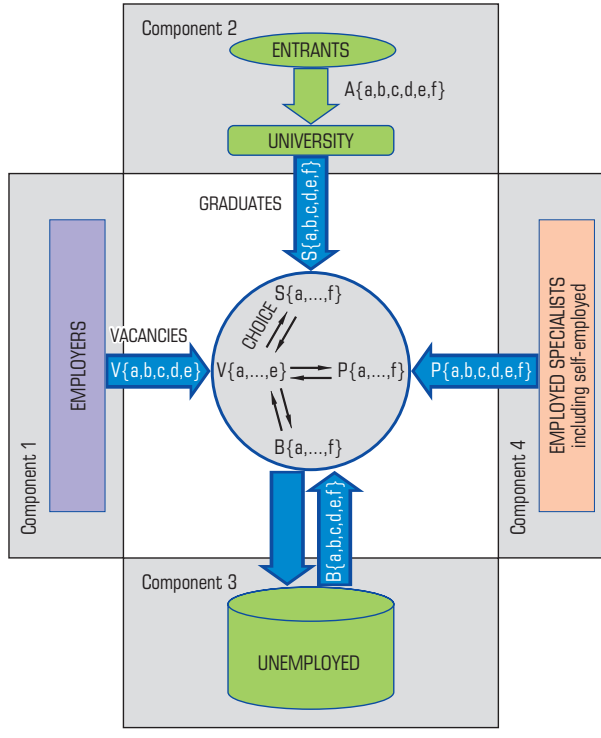
The labor market consists of at least four components that interact and provide continuous movement. Assume that the following components interact (**Fig. 2.1**):

– component 1 is employers who create vacancies and describe them in the form of $V_i\{a, b, c, d, e\}$, which describes the requirements for candidates for the job;

– component 2 – university entrants described as $A_i\{a, b, c, d, e, f\}$ and its graduates with a description in the form of $S_i\{a, b, c, d, e, f\}$;

– component 3, are the unemployed who apply for vacancies and are described as $B_i\{a, b, c, d, e, f\}$;

– component 4, these are employed professionals, including self-employed, but who are trying on vacancies in the labor market. They are described as $P_i\{a, b, c, d, e, f\}$.




a – education; b – experience; c – specialty;
d – professional competencies; e – personal competencies; f – applicant desires

**Fig. 2.1** Scheme of interaction in the labor market

The parameters of vacancies and applicants for them have the following interpretation: *a* – education; *b* – work experience; *c* – specialty (educational program); *d* – professional competencies; *e* – personal competencies, including soft skills; *f* – wishes of the applicant.

Demand and supply in the labor market by definition has two sides. Demand is assessed through an analysis of the set of vacancies that are declared by employers in terms of specialties, educational programs and other parameters. Announced vacancies are usually accompanied by a set of requirements for applicants, including not only education, work experience but also a list of professional and personal competencies $V_i\{a, b, c, d, e\}$. For its part, each candidate for a position has its own set of characteristics (parameters), including their own wishes *f*, on salary, mode of operation and so on.

Thus, in the labor market there are vacancies with their parameters and applicants – with their own. There is a choice in the process of which the parameters of vacancies and applicants are compared (**Fig. 2.1**).

$V_i\{a, b, c, d, e\}$ is compared with $S_i\{a, b, c, d, e, f\}$, or with $P_j\{a, b, c, d, e, f\}$, or with $B_j\{a, b, c, d, e, f\}$.

In the presence of coordination of parameters and wishes the vacancy is liquidated, the applicant receives the workplace.

## 2.1 QUANTITATIVE ANALYSIS OF VACANCIES BY SPECIALTIES AND EDUCATIONAL PROGRAMS IN THE REGIONAL LABOR MARKET

Let's analyze the component 1. Employers form vacancies and describe them in the form $V_i\{a, b, c, d, e\}$. The following sites were used to analyze the set of vacancies by specialties and educational programs: *rabota.ua*, *work.ua*, *jobs.ua*.

Parameter «*c*» from the vacancy formula $V_i\{a, b, c, d, e\}$.

For 2017, 2018, 2021, 396,955 vacancies were offered in the ads. During this period, the list of specialties and educational programs for which specialists are trained at the university has changed somewhat. The specialty «Entrepreneurship, Trade and Exchange Activities» was added, which included, among other things, the educational program «Real Estate Management». Not only the list of specialties (groups of specialties) has changed, but also their popularity among employers (**Table 2.1**). Column 2 of this table lists specialties, educational programs and their groups. This combination is due to the similarity of professional competencies, which are listed in the ads according to the vacancies. Employers, as a rule, do not use the official list of specialties, because they are not interested in the names of specialties, but the list of competencies of job applicants.

Therefore, for the convenience of teaching the material in the future we will call specialties, educational programs and their groups, which are presented in **Table 2.1** by the term «specialty».

In the first place in 2021 the specialty «Entrepreneurship, trade and exchange activity» was fixed. Employers offered 14,321 vacancies in this specialty, which is 21.3 % of the total.

● **Table 2.1** Number of vacancies in ads by groups of specialties

| Year | 2017 | | 2018 | | 2021 | |
|---|---|---|---|---|---|---|
| **Groups of specialties and educational programs** | **Quantity** | **Share, %** | **Quantity** | **Share, %** | **Quantity** | **Share, %** |
| Entrepreneurship, trade and exchange activities | – | – | – | – | 14,321 | 21.3 |
| Management | 75,887 | 40.8 | 45,115 | 31.3 | 13,615 | 20.3 |
| Information technologies | 22,178 | 11.9 | 17,131 | 11.9 | 8,635 | 12.9 |
| Accounting and auditing | 18,835 | 10.1 | 15,854 | 11.0 | 5,861 | 8.7 |
| Marketing, advertising and PR, media communications | 8,664 | 4.7 | 9,346 | 6.5 | 5,181 | 7.7 |
| Economics of enterprise | 16,300 | 8.8 | 13,737 | 9.5 | 3,434 | 5.1 |
| Financial management | 4,620 | 2.5 | 3,455 | 2.4 | 3,421 | 5.1 |
| Economic cybernetics and applied statistics | 13,605 | 7.3 | 12,396 | 8.6 | 2,808 | 4.2 |
| Personnel management | 2,785 | 1.5 | 5,240 | 3.6 | 2,032 | 3.0 |
| Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 6,816 | 3.7 | 2,164 | 1.5 | 1,612 | 2.4 |
| Tourism, hotel and restaurant business | 1,450 | 0.8 | 1,450 | 1.0 | 1,513 | 2.3 |
| Logistics | 5,422 | 2.9 | 5,965 | 4.1 | 1,511 | 2.2 |
| Banking | 7,429 | 4.0 | 6,953 | 4.8 | 1,311 | 2.0 |
| International economic relations, international economics, international relations | 1,846 | 1.0 | 1,937 | 1.3 | 912 | 1.4 |
| Legal regulation of economy | – | – | 1,061 | 0.7 | 776 | 1.2 |
| Customs affairs | – | – | 359 | 0.2 | 130 | 0.2 |
| Management of social sphere | – | – | 251 | 0.2 | 116 | 0.2 |
| Real estate management | – | – | 1,515 | 1.1 | – | – |
| Total number | 185,837 | 100 | 143,929 | 100.0 | 67,189 | 100 |

In the second place in 2021 is the specialty «management», the number of vacancies for it is 13,625 units, which is 20.3 % of the total.

Their leadership, according to the author, is due to a wide range of positions that can be held by specialists in these specialties. Moreover, sometimes it is extremely difficult to determine the priority of each of them in relation to a particular position, because the required professional competencies are similar in content.

Firm positions in the labor market are occupied by specialties under the general name «information technology», these specialties include: «computer science», «managing information systems and technologies», «cybersecurity», «software engineering». The number of vacancies in these specialties in 2021 amounted to 8,635 units, which is 12.9 % of the total. Since 2017, the share of vacancies in these specialties has increased by 1 %.

In this context, the positions of the specialty «Accounting and Auditing» decreased slightly. Compared to 2017, its share decreased from 10.1 % to 8.7 %.

The position of the group of specialties under the conditional name «marketing, advertising and PR, media communications» has considerably strengthened. Compared to 2017, the share of the number of vacancies in these specialties has almost doubled from 4.7 % to 7.7 %.

The share of the number of vacancies in the educational program «Financial Management» has doubled. In 2017, it had 2.5 %, while in 2021 it gained 5.1 %. The share of the group of specialties «tourism, hotel and restaurant business» has more than doubled, from 0.8 % in 2017 to 2.3 % in 2021.

In general, the analysis of the dynamics of vacancies in the regional labor market for the specialties in which the university trains specialists allows to reasonably build a marketing strategy for its development.

Vacancies as their parameters have not only the specialties for which the analysis was conducted, but also the level of education, work experience.

Parameter «b» from the vacancy formula $V_i\{a, b, c, d, e\}$.

An important requirement in the ads is the presence of experience in the specialty. Data processing of ads for 2016, 2017, 2018, 2021 in relation to the requirements of work experience are presented in **Table 2.2**.

The least demanding in terms of work experience are employers in the educational program «Banking». Proposals for specialists in this educational program without work experience contain an average of 46.65 % of ads per year. Also, small requirements for work experience are put forward in advertisements for specialists in specialties and educational programs: «entrepreneurship, trade, exchange activities», «personnel management», «social management», «legal regulation of the economy». For them, the average percentage of vacancies over the years without the requirement of work experience ranges from 27.7 % to 34.1 %.

According to the obtained data, the most demanding to work experience are employers for specialists with the educational program «Accounting and Auditing». Only 11.3 % of advertisements offer jobs for these professionals without work experience, while on average, 56 % of advertisements offer jobs for candidates with three or more years of work experience.

High requirements for work experience on average over the years have ads for educational programs in the field of «Information Technology» – 45.5 % of ads, educational program «Technology of electronic multimedia publications and computer technology and systems of publishing and printing publications» – 42.6 % announcements, educational programs «Management» – 43.9 %, group of specialties and educational programs «International Economic Relations, International Economics, International Relations» – 39.1 %, educational program «Customs» – 36.8 %.

**Table 2.2** Requirements for experience as a percentage of the number of ads

| Groups of specialties and educational programs | No experience | | | | Average % by years | Work experience three or more years | | | | Average % by years |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2021 | | 2016 | 2017 | 2018 | 2021 | |
| Entrepreneurship, trade and exchange activities | – | – | – | 32 | – | – | – | – | 11.3 | – |
| Management | 25.0 | 27.3 | 27.1 | 16.2 | 23.9 | 42.8 | 47.7 | 42.4 | 42.6 | 43.9 |
| Information technologies | 20.7 | 14.7 | 19.2 | 18.2 | 18.2 | 42.1 | 54.7 | 57.7 | 27.3 | 45.5 |
| Accounting and auditing | 11.8 | 11.8 | 14.0 | 7.7 | 11.3 | 52.2 | 52.9 | 53.5 | 65.4 | 56.0 |
| Economics of enterprise | 20.5 | 23.1 | 16.1 | 6.4 | 16.5 | 4.5 | 42.3 | 45.2 | 38.3 | 32.6 |
| Economic cybernetics and applied statistics | 14.9 | 22.7 | 30.8 | 7.1 | 18.9 | 8.5 | 36.4 | 46.2 | 42.9 | 33.5 |
| Marketing, advertising and PR, media communications | 30.1 | 32.0 | 32.3 | 25.0 | 29.9 | 39.3 | 24 | 29 | 14.3 | 26.7 |
| Banking | 33.9 | 55.6 | 50.0 | 47.1 | 46.7 | 3.2 | 16.7 | 21.4 | 5.9 | 11.8 |
| Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 40.0 | 8.0 | 26.9 | 7.7 | 20.7 | 25 | 76 | 46.2 | 23.1 | 42.6 |
| Logistics | 25.3 | 23.1 | 25.9 | 21.4 | 23.9 | 43.4 | 23.1 | 33.3 | 28.6 | 32.1 |
| Financial management | 24.7 | 35.7 | 31.3 | 16.7 | 27.1 | 14.3 | 35.7 | 34.4 | 33.3 | 29.4 |
| Personnel management | 34.8 | 23.8 | 18.8 | 33.3 | 27.7 | 10.7 | 61.9 | 53.1 | 13.3 | 34.8 |
| International economic relations, international economics, international relations | 15.2 | 20.0 | 18.2 | 21.1 | 18.6 | 51.5 | 30 | 48.5 | 26.3 | 39.1 |
| Tourism, hotel and restaurant business | 22.2 | 33.3 | 34.6 | 14.3 | 26.1 | 1.9 | 22.2 | 30.8 | 14.3 | 17.3 |
| Customs affairs | 0.0 | 24.2 | 23.8 | 9.1 | 19.0 | 0 | 45.3 | 28.6 | 36.4 | 36.8 |
| Management of social sphere | 0.0 | 0.0 | 26.3 | 36.4 | 31.4 | 0 | 0 | 47.4 | 27.3 | 37.4 |
| Legal regulation of economy | 0.0 | 0.0 | 34.8 | 33.3 | 34.1 | 0 | 0 | 21.7 | 16.7 | 19.2 |
| Real estate management | 0.0 | 0.0 | 72.7 | – | – | 0 | 0 | 9.1 | – | – |
| Weighted average score | 23.2 | 24.2 | 25.7 | 20.2 | – | 32.5 | 45.3 | 43.5 | 29.5 | – |

The annual weighted average percentage of vacancies that do not require work experience in all specialties and their groups have a steady downward trend. If in 2016 the percentage of such vacancies was 23.2 %, in 2021 it was 20.2 %. In addition, there is a significant reduction in the annual weighted average percentage of vacancies that require work experience of three years or more. In 2016, this percentage was 32.5 %, while in 2021 it decreased to 29.5 %.

Thus, there is a tendency to reduce the percentage of vacancies that do not require work experience and the percentage of vacancies that require work experience of three years or more. In advertisements, when determining the parameter «*b*» from the vacancy formula $V_i\{a, b, c, d, e\}$, the requirement of work experience for 1–2 years is quite common. The percentage of such vacancies increased from 44.3 % in 2016 to 50.3 % in 2021.

The specialty «accounting and auditing» and the educational program «business economics» fall out of this generalized trend. For such specialists, the percentage of vacancies with more than three years of work experience increases from year to year, while the number of vacancies without work experience decreases.

In general, it can be argued that a significant competitive advantage of the applicant for a vacancy is work experience and a strong practical component in the curricula of the relevant HEI. A real way to ensure the success of graduates in the labor market is the introduction of distance learning. In [17] the analysis of domestic experience of introduction of this form and long-term experience of Germany in this sphere is carried out. The following conclusion is made: «Thus, there is no dual system yet, and DS is defined as a form of education, which does not limit it to the need of establishing HEEs specialized in dual studies etc. Ukraine is creating its mechanism of dual studies. The author's questionnaire survey on the results of the first year of the experiment of the MES on the introduction of the dual studies showed that Ukraine could successfully adapt German best practices if a flexible approach is applied. Though some significant elements of the dual studies as a system are missing, the launch may be considered effective based on the cases of in-depth cooperation of HEEs and companies that meet the philosophy of dual studies and the national legislative requirements to the DS».

The analysis allows to draw a reasonable conclusion about the urgent need to transform the work of the university in the direction of strengthening the practical component of the educational process. This work should be organized in such a way that graduates have the opportunity to obtain a certificate of practical work in the specialty. This can be organized within all types of practice in agreement with the relevant organizations and with the help of reputable international distance learning platforms.

In order to assess the real volume of the labor market, the management of HEIs needs to study not only the demand for specialists in a particular specialty, with a particular work experience, but also to determine the required level of education from the point of view of employers.

Parameter «a» from the vacancy formula $V_i\{a, b, c, d, e\}$.

The analysis of announcements for 2016–2018 and 2021 allowed to summarize the data on the requirements of employers to candidates for the job, given the availability of higher education in general, and special higher education in particular (**Table 2.3**). From the text of the advertisements, it is usually clear whether the candidate is required to have higher education or not, this can be said with particular confidence if the need for special education is specified. Sometimes the requirement for a candidate to have a higher education stems from the context of the advertisements. It should be clarified that the analyzed tables in the column «Branches of knowledge, groups of specialties,

educational programs» do not always give the correct names of specialties, educational programs, as the authors of ads do not always have a valid list of specialties and educational programs. During the analysis of advertisements, where the list of positions is mainly presented, and not the specialty or educational program, the groups of specialties listed were singled out, including in **Table 2.3**.

● **Table 2.3** Requirements of employers to candidates in terms of educational level as a percentage of the total number of ads

| Groups of specialties and educational programs | Higher Education, % | | | | Average value | Specialized higher education, % | | | | Average value |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2021 | | 2016 | 2017 | 2018 | 2021 | |
| Entrepreneurship, trade and exchange activities | – | – | – | 35.1 | – | – | – | – | 1.0 | – |
| Management | 50.8 | 31.8 | 30.5 | 47.1 | 40.1 | 10.2 | 27.3 | 15.3 | 7.3 | 15.0 |
| Information technologies | 48.2 | 13.3 | 23.1 | 23.6 | 27.1 | 12.8 | 73.3 | 51.3 | 5.4 | 35.7 |
| Accounting and auditing | 67.8 | 29.4 | 30.2 | 42.3 | 42.4 | 6.1 | 52.9 | 44.2 | 26.9 | 32.5 |
| Economics of enterprise | 59.1 | 26.9 | 32.3 | 34.0 | 38.1 | 2.3 | 19.2 | 12.9 | 21.3 | 13.9 |
| Economic cybernetics and applied statistics | 57.4 | 0.0 | 33.3 | 28.6 | 29.8 | 8.5 | 36.4 | 20.5 | 28.6 | 23.5 |
| Marketing, advertising and PR, media communications | 52.8 | 32.0 | 29.0 | 32.1 | 36.5 | 11.0 | 28.0 | 32.3 | 3.6 | 18.7 |
| Banking | 72.6 | 33.3 | 25.0 | 35.3 | 41.6 | 3.2 | 5.6 | 17.9 | 29.4 | 14.0 |
| Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 10.0 | 12.0 | 23.1 | 30.8 | 19.0 | 5.0 | 48.0 | 30.8 | 0.0 | 21.0 |
| Logistics | 61.4 | 61.5 | 44.4 | 42.9 | 52.6 | 4.8 | 7.7 | 14.8 | 0.0 | 6.8 |
| Financial management | 71.4 | 14.3 | 25.0 | 12.5 | 30.8 | 7.8 | 42.9 | 40.6 | 54.2 | 36.4 |
| Personnel management | 67.0 | 52.4 | 50.0 | 33.3 | 50.7 | 1.8 | 14.3 | 21.9 | 0.0 | 9.5 |
| International economic relations, international economics, international relations | 60.6 | 65.0 | 48.5 | 31.6 | 51.4 | 9.1 | 15.0 | 12.1 | 10.6 | 11.7 |
| Tourism, hotel and restaurant business | 60.2 | 55.6 | 50.0 | 57.1 | 55.7 | 0.0 | 5.6 | 3.8 | 0.0 | 2.4 |
| Customs affairs | 0.0 | 0.0 | 42.9 | 45.5 | 44.2 | 0.0 | 0.0 | 42.9 | 9.1 | 26.0 |
| Management of social sphere | 0.0 | 0.0 | 15.8 | 36.4 | 26.1 | 0.0 | 0.0 | 57.9 | 36.4 | 47.2 |
| Legal regulation of economy | 0.0 | 0.0 | 34.8 | 16.7 | 25.8 | 0.0 | 0.0 | 65.2 | 50.0 | 57.6 |
| Real estate management | 0.0 | 0.0 | 22.7 | – | – | 0.0 | 0.0 | 4.5 | – | – |
| Weighted average score | 58.6 | 27.2 | 31.1 | 35.6 | – | 7.2 | 34.6 | 25.5 | 18.0 | – |

These tables show that the most demanding to have any higher education of the candidate are employers in the following specialties and educational programs: «tourism, hotel and restaurant business» – 56 %; group of specialties and educational programs «International Economic Relations, International Economics, International Relations» – 44.8 %; «Personnel Management» – 44.9 %; «Logistics» – 49.4 %.

The least demanding for higher education are employers in the following educational programs: «Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing publications» – 22.9 % and educational programs in the field of knowledge «Information Technologies» – 25.9 %. According to the author, this does not indicate a weak requirement for the competence of the candidate, but the relative ease of testing this professional competence in the recruitment process.

According to **Table 2.3**, the largest percentage of vacancy announcements requiring special higher education relates to the educational program «Financial Management» on average by years – 59.2 %, announcements for the educational program «Legal Regulation of the Economy» – 57.6 % of announcements, and also for the educational program «accounting and auditing» – 30.7 % of ads.

The parameter «*d*» from the vacancy formula $V_i\{a, b, c, d, e\}$ refers to professional competencies.

Among the professional competencies, computer and language occupy a special place. Ads often emphasize them. The research conducted in 2021 made it possible to concentrate the results in the form of **Table 2.4**.

An analysis of the 2021 announcements showed that the requirements for professional competencies in specialties and educational programs have remained stable over the last 5–6 years. Their list of specialties and educational programs is presented in the author's monograph [18]. As an example, we present the results of the analysis of announcements in 2021 for vacancies in the specialty «Entrepreneurship, trade, exchange activities» (see **Table 2.5**).

The parameter «*e*» from the vacancy formula $V_i\{a, b, c, d, e\}$ refers to personal competencies.

Research 2021 has shown that regardless of specialties, educational programs personal competencies, including Soft Skills have their own hierarchy. According to the number of vacancies in which employers require them, the most in demand are sociability and responsibility (**Table 2.6**).

An analysis of the 2021 announcements showed that the requirements for personal competencies in specialties and educational programs have remained stable over the last 5–6 years. Their list of specialties and educational programs is presented in the author's monograph [18].

For example in **Table 2.7** the results of the analysis of announcements in 2021 in the specialty «Entrepreneurship, trade and exchange activities» are provided. In this specialty, employers more strongly require applicants for the job competencies «sociability», «literate written and oral speech», «responsibility» (respectively – 44.2 %; 29.5 %; 25.3 %) than in on average in all specialties (respectively 26.7 %; 14.6 %; 17.6 %). See **Table 2.6**, **2.7**.

**Table 2.4** Percentage of vacancies for computer and language competencies in advertisements

| Groups of specialties and educational programs | Computer competencies (%) | Language competences (%) |
|---|---|---|
| Entrepreneurship, trade and exchange activities | 39.2 | 5.2 |
| Management | 50.0 | 10.3 |
| Information technologies | 100.0 | 36.4 |
| Accounting and auditing | 65.4 | 3.8 |
| Economics of enterprise | 68.1 | 12.8 |
| Economic cybernetics and applied statistics | 92.9 | 28.6 |
| Marketing, advertising and PR, media communications | 67.9 | 25.0 |
| Banking | 35.3 | 11.8 |
| Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 100.0 | 38.5 |
| Logistics | 64.3 | 14.3 |
| Financial management | 58.3 | 33.3 |
| Personnel management | 53.3 | 13.3 |
| International economic relations, international economics, international relations | 42.1 | 36.8 |
| Tourism, hotel and restaurant business | 42.9 | 21.4 |
| Customs affairs | 27.3 | 0.0 |
| Management of social sphere | 45.5 | 0.0 |
| Legal regulation of economy | 50.0 | 16.7 |
| Weighted average score | 61.0 | 16.7 |

**Table 2.5** Entrepreneurship, trade and exchange activities

| Professional competencies | Number, % |
|---|---|
| Computer skills | 39.2 |
| MS Office | 23.2 |
| «1C» (accounting software) skills | 20.0 |
| Sales skills | 7.4 |
| B2B sales | 7.4 |
| Market analysis | 5.3 |
| Knowledge of a foreign language | 5.2 |
| Monitoring the Regulation implementation | 3.2 |
| HTML | 3.2 |

**Table 2.6** Demand for personal competencies in the ads of employers, %

| Characteristics | Weighted average score, % |
|---|---|
| 1 | 2 |
| Sociability | 26.7 |
| Responsibility | 17.6 |
| Competent written and oral speech | 14.6 |
| Result orientation | 14.4 |
| Ability to work in a team | 12.7 |
| Attentiveness, pedantic, meticulousness | 12.5 |
| Desire to develop | 11.8 |
| Activity, energy | 10.3 |
| Analytical thinking | 9.2 |
| Stress resistance | 9.2 |
| Active life position | 7.7 |
| Ability to work with a large amount of information | 7.5 |
| Ability to learn quickly | 6.8 |
| Organizational skills | 6.0 |
| Customer focus | 5.9 |
| Purposefulness | 5.8 |
| Punctuality | 5.7 |
| Organization and planning skills | 5.5 |
| Working capacity | 3.8 |
| Presentable appearance | 3.7 |
| Emotional intelligence, interpersonal skills | 3.6 |
| Independence | 3.4 |
| Creativity (creative thinking) | 3.4 |
| Initiativity | 3.3 |
| Speed in making the right decisions | 3.1 |
| Perseverance, patience | 3.0 |
| Multitasking | 2.7 |
| Decency, honesty, principledness | 2.7 |
| Artistic taste and sense of style | 2.6 |
| Politeness, tact | 2.5 |
| Persistence | 2.2 |
| Sense of humor | 2.2 |
| Leadership qualities | 2.1 |
| Ambitiousness | 2.0 |
| Strategic and systematic thinking | 1.7 |
| Goodwill | 1.7 |

● **Continuation of Table 2.6**

| 1 | 2 |
|---|---|
| High efficiency | 1.7 |
| Discipline | 1.5 |
| Confidence | 1.5 |
| Innovation (the desire to study new products, markets, innovation) | 1.4 |
| Ability to persuade and defend their point of view | 1.2 |
| Ability to understand new technologies | 1.2 |
| Flexibility | 1.2 |
| Critical thinking | 1.2 |
| Precision and accuracy | 1.1 |
| Diligence | 1.0 |
| Operativity | 0.6 |
| Ability to listen and hear the interlocutor | 0.5 |
| Positivity | 0.2 |

● **Table 2.7** Demand for competencies in the specialty «Entrepreneurship, trade and exchange activities»

| Personal competencies | Number, % |
|---|---|
| Sociability | 44.2 |
| Competent written and oral speech | 29.5 |
| Responsibility | 25.3 |
| Result orientation | 21.1 |
| Desire to develop | 18.9 |
| Gender and age | 16.8 |
| Activity, energy | 16.8 |
| Active life position | 11.6 |
| Ability to work in a team | 11.6 |
| Customer focus | 10.5 |
| Punctuality | 10.5 |
| Purposefulness | 10.5 |
| Presentable appearance | 9.5 |
| Attentiveness, pedantic, meticulousness | 9.5 |
| Stress resistance | 8.4 |
| Own car or driving license | 7.4 |
| Politeness, tact | 6.3 |
| Ability to learn quickly | 5.3 |
| Organizational skills | 5.3 |
| Organization and ability to plan | 5.3 |
| Working capacity | 5.3 |

## 2.2 EVALUATION OF THE POPULARITY OF GROUPS OF SPECIALTIES AND EDUCATIONAL PROGRAMS

Component 2 – university entrants described as $A_i\{a, b, c, d, e, f\}$ and its graduates with a description in the form of $S_i\{a, b, c, d, e, f\}$ with the following parameters: $a$ – education; $b$ – work experience; $c$ – specialty (educational program); $d$ – professional competencies; $e$ – personal competencies, including soft skills; $f$ – wishes of the applicant.

Specialists from almost all universities evaluate the motives of entrants' choice of specialties and educational programs, as such analysis allows to build a marketing strategy. For example, Myroslava Hladchenko presented her research in [19], which states:

«To summarise, as was argued in the theoretical framework, student choice is affected by the combination of sociological and economic factors. The findings of this research reveal that among the sociological factors affecting the Ukrainian students' choice of university and programme is the grade-point average in secondary education, family culture and family wealth. Economic factors include incentives such as tuition fees, scholarships and other student support facilities, entrance rules, societal expectations, proximity to the university. These factors influence student choice in various ways».

Such conclusions do cover almost all the factors that may influence the choice of applicants, but some aspects need further clarification and quantification.

It is necessary to evaluate the possibility of assessing the impact of many vacancies $V_i\{a, b, c, d, e\}$ on the choice of applicants.

To do this, we compare the number of vacancies in the labor market with the number of applications submitted to the university, respectively, specialties or their groups. We will analyze the average annual data on vacancies for 2017–2021, and the annual number of applications on average for 2017–2019 and separately for 2020, 2021. The selection in the study separately 2020, 2021 years is due to the hypothesis of the possibility of the impact of the pandemic, both on the labor market and on the priorities of applicants.

In addition, from the site «https://vstup.osvita.ua/ – Admission to the bachelor's degree» we will take data on the number of applications in 2019–2021 by specialties or their groups in general in Ukraine (allocation of the number of applications for educational programs is made in proportion to this distribution at the university). All actual data are given in **Table 2.10**.

According to the data obtained by university scientists on the analysis of advertisements for 2017–2021, annually there were an average of 141,810 vacancies in 17 groups of specialties and educational programs.

**Table 2.8** presents the structure of vacancies by these groups of specialties and educational programs on average for 2017, 2018 and separately for 2021. Thus, it is possible to assess the impact of the COVID-19 virus pandemic on the structure of the regional labor market.

At first glance, in 2021 the share of vacancies in the specialty «management» decreased significantly. Indeed, the share of such vacancies in 2021 is 20.3 %, while in 2017–2018 their share was 36.7 %. However, if we take into account the fact that in 2017, 2018, university scientists

did not consider vacancies in the specialty «entrepreneurship, trade and exchange activities», this difference will not be so impressive. The fact is that the ads do not directly indicate the specialty and therefore, most of the vacancies in this specialty were attributed to the «management».

**Table 2.8** The number of vacancies in the ads by groups of specialties and educational programs

| Year | Average 2017–2018 | | 2021 | |
|---|---|---|---|---|
| **Groups of specialties** | **Number** | **Share, %** | **Number** | **Share, %** |
| Entrepreneurship, trade and exchange activities | – | – | 14,321 | 21.3 |
| Management | 60,501 | 36.9 | 13,615 | 20.3 |
| Information technologies | 19,655 | 12.0 | 8,635 | 12.9 |
| Accounting and auditing | 17,345 | 10.6 | 5,861 | 8.7 |
| Marketing, advertising and PR, media communications | 9,005 | 5.5 | 5,181 | 7.7 |
| Economics of enterprise | 15,019 | 9.2 | 3,434 | 5.1 |
| Financial management | 4,038 | 2.5 | 3,421 | 5.1 |
| Economic cybernetics and applied statistics | 13,001 | 7.9 | 2,808 | 4.2 |
| Personnel management | 4,013 | 2.4 | 2,032 | 3.0 |
| Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 4,490 | 2.7 | 1,612 | 2.4 |
| Tourism, hotel and restaurant business | 1,450 | 0.9 | 1,513 | 2.3 |
| Logistics | 5,694 | 3.5 | 1,511 | 2.2 |
| Banking | 7,191 | 4.4 | 1,311 | 2.0 |
| International economic relations, international economics, international relations | 1,892 | 1.2 | 912 | 1.4 |
| Legal regulation of economy | 531 | 0.3 | 776 | 1.2 |
| Customs affairs | 180 | 0.1 | 130 | 0.2 |
| Management of social sphere | 126 | 0.1 | 116 | 0.2 |
| Total | 164,127 | 100 | 67,189 | 100 |

Really significant changes in the structure of the labor market are taking place in the educational programs «business economics» and «economic cybernetics, applied statistics». Under these educational programs, the share of the number of vacancies decreased by about 4 %. Reduction in the number of vacancies by weight in the range of 1–2 % percent also occurs in educational programs «accounting and auditing», «logistics», «banking».

An increase in the number of vacancies by weight in the range of 1–2 % percent is observed in the following groups of educational programs «information technology», «marketing, advertising and PR, media communication», «legal regulation of the economy».

The growth in the number of vacancies in the specialties «tourism, hotel and restaurant business» is not significant, because until 2019 the calculation of vacancies was carried out only in the specialty «tourism» and only from 2020 the university began to recruit applicants for the specialty «hotel and restaurant business» and began to count relevant vacancies.

In general, the change in the structure of vacancies corresponds to the logic of the impact of pandemics on the development of the country's economy. Indeed, quarantine and, especially, lockdown, on the one hand, slowed down the development of enterprises, and on the other hand stimulated the development of IT business, marketing, advertising and PR – technology, media communications, legal services.

The next step, by logic, is to study the impact of the pandemic on demand for certain specialties from applicants. First of all, we will analyze the changes in the structure of the number of applications of university entrants, respectively, groups of specialties and educational programs in 2020, 2021 in relation to the average values in 2017–2019 (columns 3.5 of **Table 2.9**).

● **Table 2.9** The structure of the number of applications from applicants for the bachelor's degree to the university by groups of specialties and educational programs

| **Year** | **Average 2017–2019** | | **Average 2020–2021** | |
|---|---|---|---|---|
| **Groups of specialties** | **Number** | **Share, %** | **Number** | **Share, %** |
| Entrepreneurship, trade and exchange activities | – | – | 452.5 | 3.7 |
| Management | 1,432 | 18.07 | 2,016 | 16.6 |
| Information technologies | 795 | 10.03 | 1,879 | 15.5 |
| Accounting and auditing | 352 | 4.44 | 303 | 2.5 |
| Marketing, advertising and PR, media communications | 1,262 | 15.92 | 1,827.5 | 15.1 |
| Economics of enterprise | 913 | 11.52 | 292 | 2.4 |
| Financial management | 182 | 2.30 | 373.5 | 3.1 |
| Economic cybernetics and applied statistics | 195 | 2.46 | 336 | 2.8 |
| Personnel management | 214 | 2.70 | 219.5 | 1.8 |
| Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 208 | 2.62 | 346 | 2.9 |
| Tourism, hotel and restaurant business | 711 | 8.97 | 1,025 | 8.5 |
| Logistics | 270 | 3.41 | 362 | 3.0 |
| Banking | 363 | 4.58 | 231 | 1.9 |
| International economic relations, international economics, international relations | 492 | 6.21 | 1,433 | 11.8 |
| Legal regulation of economy | 233 | 2.94 | 461.5 | 3.8 |
| Customs affairs | 162 | 2.04 | 265 | 2.2 |
| Management of social sphere | 141 | 1.78 | 291.5 | 2.4 |
| Total | 7,925 | 100 | 12,114 | 100 |

The most significant changes concern the educational program «business economics» for which the percentage of applications in total decreased from 11.52 % to 2.4 %. This reduction corresponds to the dynamics of the number of vacancies in this educational program and is due to the consequences of the pandemic. In line with the impact of the pandemic, there is also a reduction in the share of applications in the range of 1–2 % in the following specialties and educational programs «management», «accounting and auditing», «personnel management», «banking».

The share of applications for the group of specialties «information technology» has significantly increased from 10.03 % in 2017–2019 to 15.5 % in 2020–2021. The share of applications for international and legal specialties has increased (**Table 2.9**, columns 3.5). Changes in the popularity of specialties during the pandemic period, which is characterized by a change in the structure of applications of applicants, generally correspond to changes in the structure of vacancies.

**Table 2.10** presents data on the structure of the number of applications for entrants for 2019–2021 in Ukraine as a whole. Comparing the structure of applicants' applications for different years makes it possible to assess the impact of the pandemic on their preferences.

In 2020, 2021 there is a decline in the share of applications in the specialties «management», «accounting and auditing», «marketing, advertising and PR, media communications», «legal regulation of the economy». Thus, if the decrease in the share of applications for the specialty «management» and the educational program «Accounting and Auditing» coincides with the trend of changes in the number of applications to the university, the share of applications for the educational program «legal regulation of the economy» and the group of specialties and educational programs «Marketing, advertising and PR, media communications» does not have such a pronounced trend. At the university, the share of applications for these specialties and educational programs is almost unchanged.

At the state level, the share of applications has increased significantly in the following specialties and educational programs: «economic cybernetics and applied statistics», «logistics», «personnel management», «banking».

At the university, the share of applications in the specialties «economic cybernetics and applied statistics» and «logistics» is almost unchanged at this time, while in the educational programs «personnel management» and «banking» – has the opposite trend. Under these educational programs, there is a decrease in the share of applications from entrants to the university. This means that the decline in the popularity of these educational programs is not due to a pandemic. Probably the reason is the decrease in the quality of career guidance work of the relevant departments.

Component 3 is the unemployed who apply for vacancies and are described as $B_i\{a, b, c, d, e, f\}$, where in addition to the already described parameters: $a$ – education; $b$ – work experience; $c$ – specialty (educational program); $d$ – professional competencies; $e$ – personal competencies, including soft skills; the parameter $f$ – wishes of the applicant is added.

The number of unemployed in Kharkiv region tends to increase. Thus, the total number of unemployed in 2020 compared to 2016 increased by 4.9 % (4,253 people), and compared to 2019 – by 21 % (15,622 people). It should be noted that the number of unemployed in

the Kharkiv region from 2016 to 2019 gradually decreased, and in 2020 there was a significant increase in their number, which was due to the pandemic COVID-19.

● **Table 2.10** The structure of the number of applications of entrants to the HEIs of Ukraine for the bachelor's level of education

| No. | Groups of specialties, educational programs | Number 2019 | Share, % | Number 2020 | Share, % | Number 2021 | Share, % |
|---|---|---|---|---|---|---|---|
| 1 | Entrepreneurship, trade and exchange activities | – | – | 19,619 | 3.41 | 20,389 | 2.9 |
| 2 | Management | 54,756 | 13.11 | 54,984 | 9.55 | 57,856 | 8.2 |
| 3 | Information technologies | 115,228 | 27.58 | 102,302 | 17.78 | 185,794 | 26.2 |
| 4 | Accounting and auditing | 14,187 | 3.40 | 12,588 | 2.19 | 12,264 | 1.7 |
| 5 | Marketing, advertising and PR, media communications | 56,141 | 13.44 | 51,448 | 8.94 | 61,117 | 8.6 |
| 6 | Economics of enterprise | 20,798 | 4.98 | 32,230 | 5.60 | 35,338 | 5.0 |
| 7 | Financial management | 7,283 | 1.74 | 20,927 | 3.64 | 22,987 | 3.2 |
| 8 | Economic cybernetics and applied statistics | 3,918 | 0.94 | 32,230 | 5.60 | 35,338 | 5.0 |
| 9 | Personnel management | 5,426 | 1.30 | 32,230 | 5.60 | 35,338 | 5.0 |
| 10 | Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 1,605 | 0.38 | 1,923 | 0.33 | 2,646 | 0.4 |
| 11 | Tourism, hotel and restaurant business | 26,485 | 6.34 | 32,975 | 5.73 | 35,915 | 5.1 |
| 12 | Logistics | 10,556 | 2.53 | 54,984 | 9.55 | 57,856 | 8.2 |
| 13 | Banking | 3,493 | 0.84 | 20,927 | 3.64 | 22,987 | 3.2 |
| 14 | International economic relations, international economics, international relations | 14,458 | 3.46 | 30,441 | 5.29 | 32,869 | 4.6 |
| 15 | Legal regulation of economy | 69,307 | 16.59 | 52,461 | 9.12 | 63,704 | 9.0 |
| 16 | Customs affairs | 7,283 | 1.74 | 20,927 | 3.64 | 22,987 | 3.2 |
| 17 | Management of social sphere | 6,813 | 1.63 | 2,294 | 0.40 | 2,558 | 0.4 |
| | Total number | 417,737 | 100 | 575,490 | 100 | 707,943 | 100 |

For the period from 2016 to 2020, the percentage of unemployed by groups of specialties and educational programs for which specialists are trained at the university remains at 8.3–10.2 % of the total number of unemployed in the Kharkiv region (**Table 2.11**).

● **Table 2.11** Information on the number of unemployed who were registered in the employment service of Kharkiv region during 2016–2020 in terms of groups of specialties and educational programs (primary data from [20], author's processing)

| Groups of specialties, educational programs | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Persons | % | Persons | % | Persons | % | Persons | % | Persons | % |
| In total unemployed registered by the employment service | 86,101 | – | 81,386 | – | 76,788 | – | 74,732 | – | 90,354 | – |
| including the unemployed from a specified list of groups of specialties, educational programs: | 8,661 | 10.1 | 8,119 | 9.98 | 7,842 | 10.2 | 6,207 | 8.3 | 9,259 | 10.2 |
| Management | 1,546 | 1.8 | 1,661 | 2 | 1,694 | 2.2 | 1,365 | 1.8 | 2,393 | 2.6 |
| Information technologies | 375 | 0.4 | 284 | 0.3 | 247 | 0.3 | 285 | 0.4 | 456 | 0.5 |
| Accounting and auditing | 2,326 | 2.7 | 2,127 | 2.6 | 2,015 | 2.6 | 1,495 | 2.0 | 1,923 | 2.1 |
| Economics of enterprise | 1,069 | 1.2 | 901 | 1.1 | 754 | 1 | 603 | 0.8 | 836 | 0.9 |
| Economic cybernetics and applied statistics | 38 | 0.04 | 27 | 0.03 | 31 | 0.04 | 35 | 0.05 | 48 | 0.1 |
| Marketing, advertising and PR, media communications | 1,184 | 1.4 | 1,280 | 1.6 | 1,318 | 1.7 | 1,121 | 1.5 | 1,552 | 1.7 |
| Banking, financial management and insurance | 836 | 1.0 | 658 | 0.8 | 595 | 0.8 | 352 | 0.5 | 565 | 0.6 |
| Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 31 | 0.04 | 29 | 0.04 | 29 | 0.04 | 62 | 0.1 | 99 | 0.1 |
| Logistics | 121 | 0.1 | 126 | 0.15 | 127 | 0.17 | 121 | 0.2 | 217 | 0.2 |
| Personnel management | 373 | 0.4 | 323 | 0.4 | 323 | 0.4 | 145 | 0.2 | 243 | 0.3 |
| International relations, including economic | 45 | 0.1 | 38 | 0.05 | 31 | 0.04 | 26 | 0.03 | 41 | 0.05 |
| Tourism, hotel business | 60 | 0.1 | 51 | 0.06 | 51 | 0.07 | 71 | 0.1 | 282 | 0.3 |
| Customs affairs | 27 | 0.03 | 16 | 0.02 | 11 | 0.01 | 12 | 0.02 | 19 | 0.02 |
| Management of social sphere | 179 | 0.2 | 191 | 0.2 | 200 | 0.3 | 167 | 0.2 | 156 | 0.2 |
| Legal regulation of economy | 451 | 0.5 | 407 | 0.5 | 416 | 0.5 | 347 | 0.5 | 429 | 0.5 |

Accordingly, in relation to 2019, there is an increase in the number of unemployed in the specialty «management» by 0.8 % and in the specialties of tourism, hospitality, marketing, advertising and PR, media communications by 0.2 %. In other specialties the changes do not exceed 0.1 %.

**Table 2.8** presents the structure of vacancies by specialties, which is formed on the basis of advertisements of employers, but these data are not enough to assess the validity of the popularity of applicants for certain specialties. In the author's opinion, they need to be adjusted to the

data on the unemployed. Indeed, the share of vacancies in *i*-th specialty should be reduced by the share of unemployed in this specialty. The calculation is presented in **Table 2.12,** column 6.

**Table 2.12** Estimation of the average annual share of vacancies

| No. | Groups of specialties, educational programs | The average annual number of vacancies in the ads 2017–2021 | | Average annual share of unemployed in Kharkiv region 2016–2020 | Average annual share of vacancies *SVi* |
|---|---|---|---|---|---|
| | | Number | % | | |
| 1 | Entrepreneurship, trade and exchange activities | 14,321 | 10.1 | – | 10.1 |
| 2 | Management | 44,872 | 31.6 | 2.08 | 29.52 |
| 3 | Information technologies | 15,981 | 11.3 | 0.38 | 10.92 |
| 4 | Accounting and auditing | 13,517 | 9.5 | 2.4 | 7.1 |
| 5 | Marketing, advertising and PR, media communications | 7,730 | 5.5 | 1.58 | 3.92 |
| 6 | Economics of enterprise | 11,157 | 7.9 | 1.0 | 6.9 |
| 7 | Financial management | 3,832 | 2.7 | 0.74 | 1.96 |
| 8 | Economic cybernetics and applied statistics | 9,603 | 6.8 | 0.052 | 6.75 |
| 9 | Personnel management | 3,352 | 2.4 | 0.34 | 2.06 |
| 10 | Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 3,531 | 2.5 | 0.064 | 2.44 |
| 11 | Tourism, hotel and restaurant business | 1,471 | 1.0 | 0.126 | 0.874 |
| 12 | Logistics | 4,299 | 3.0 | 0.164 | 2.836 |
| 13 | Banking | 5,231 | 3.7 | 0.74 | 2.96 |
| 14 | International economic relations, international economics, international relations | 1,565 | 1.1 | 0.054 | 1.046 |
| 15 | Legal regulation of economy | 919 | 0.6 | 0.5 | 0.1 |
| 16 | Customs affairs | 245 | 0.2 | 0.02 | 0.18 |
| 17 | Management of social sphere | 184 | 0.1 | 0.02 | 0.08 |
| | Total number | 141,810 | 100 | – | – |

In **Table 2.13** data are presented to assess the validity of the demand of applicants for higher education at the bachelor's level in a particular specialty or educational program. Let's assume that the demand of entrants for a particular specialty or educational program corresponds to the supply of the labor market in the case when the average annual share of applications does not exceed the average annual share of vacancies by more than 1.5 % per module.

**Table 2.13** Evaluation of the validity of the popularity of specialties and educational programs

| No. | Groups of specialties, educational programs (*i*) | Average annual (2017–2021) share of vacancies *SVi*, % | The average annual (2020–2021) share of applications for the university *SEAUi*, % | Average annual (2020–2021) share of applications in Ukraine, *SEASi*, % | The level of substantiation of the popularity of specialties and educational programs (–underestimated, +overestimated) | |
|---|---|---|---|---|---|---|
| | | | | | for the university *AVDUi*, % | in Ukraine *AVDSi*, % |
| 1 | Entrepreneurship, trade and exchange activities | 10.1 | 3.7 | 3.105 | –6.4 | –6.995 |
| 2 | Management | 29.52 | 16.6 | 8.875 | –12.92 | –20.645 |
| 3 | Information technologies | 10.92 | 15.5 | 21.99 | +4.58 | +11.07 |
| 4 | Accounting and auditing | 7.1 | 2.5 | 1.945 | –4.6 | –5.155 |
| 5 | Marketing, advertising and PR, media communications | 3.92 | 15.1 | 8.77 | +11.18 | +4.85 |
| 6 | Economics of enterprise | 6.9 | 2.4 | 5.3 | –4.5 | –1.6 |
| 7 | Financial management | 1.96 | 3.0 | 3.42 | +1.04 | +1.46 |
| 8 | Economic cybernetics and applied statistics | 6.75 | 2.8 | 5.3 | –3.95 | –1.45 |
| 9 | Personnel management | 2.06 | 1.8 | 5.3 | –0.26 | +3.24 |
| 10 | Technologies of electronic multimedia publications and computer technologies and systems of publishing and printing editions | 2.44 | 2.9 | 0.365 | +0.46 | –2.075 |
| 11 | Tourism, hotel and restaurant business | 0.874 | 8.5 | 5.415 | +7.626 | +4.541 |
| 12 | Logistics | 2.836 | 3.0 | 8.875 | +0.164 | +6.039 |
| 13 | Banking | 2.96 | 1.9 | 3.42 | –1.06 | +0.46 |
| 14 | International economic relations, international economics, international relations | 1.046 | 11.8 | 4.945 | +10.754 | +3.899 |
| 15 | Legal regulation of economy | 0.1 | 3.8 | 9.06 | +3.7 | +8.96 |
| 16 | Customs affairs | 0.18 | 2.2 | 3.4 | +2.02 | +3.22 |
| 17 | Management of social sphere | 0.08 | 2.4 | 0.22 | +2.32 | +0.14 |

If we indicate the average annual share of entrants' applications to the university by group of specialties, educational programs – and, as $SAEU_i$ (column 4, **Table 2.13**), and the average annual share of vacancies by the *i*-th group of specialties, educational programs in the regional labor market, as $SV_i$, (column 3, **Table 2.13**), then the assessment of the validity of demand $AVDU_i$ will be equal to the difference (column 6, **Table 2.13**):

$$AVDU_i = SEAU_i - SV_i.$$

Then:

– if $AVDU_i$ is less than or equal to ±1.5 %, then the demand of entrants for the *i* – that group of specialties, educational programs corresponds to the supply of the labor market;

– if $AVDU_i$ has a negative value and less – 1.5 %, the demand of entrants for the *i*-th group of specialties, educational programs is insufficient and does not meet the supply of the labor market (and – a group of specialties, educational programs is underestimated by entrants);

– if $AVDU_i$ has a positive value and more than 1.5 %, then the demand of entrants for the *i*-th group of specialties, educational programs is excessive and exceeds the supply of the labor market (and – a group of specialties, educational programs overestimated by entrants).

Let's mark the average annual share of entrants' applications to the HEIs of Ukraine by group of specialties, *i*-th educational programs as $SEAS_i$ (column 5, **Table 2.13**), then the assessment of the validity of demand $AVDS_i$ will be equal to the difference (column 7, **Table 2.13**):

$$AVDS_i = SEAS_i - SV_i.$$

Then:

– if $AVDS_i$ is less than or equal to ±1.5 %, then the demand of entrants for the *i* – that group of specialties, educational programs corresponds to the supply of the regional labor market;

– if $AVDS_i$ has a negative value and less – 1.5 %, the demand of entrants for the *i*-th group of specialties, educational programs is insufficient and does not meet the supply of the regional labor market (and – a group of specialties, educational programs is underestimated by entrants);

– if $AVDS_i$ has a positive value and more than 1.5 %, then the demand of entrants for the *i*-th group of specialties, educational programs is excessive and exceeds the supply of the regional labor market (and – and the group of specialties, educational programs overestimated by entrants).

Analysis of the validity of the demand of university entrants for groups of specialties, educational programs (column 6, **Table 2.13**) shows that there is a significant underestimation of some of them in the regional labor market. Underestimation is in the following groups of specialties, educational programs: «Entrepreneurship, trade and exchange activities», «management», «accounting and auditing», «business economics», «economic cybernetics and applied statistics». The value of the validity of demand for them ($AVDU_i$) varies from –3.95 % to –12.92 %. The most underestimated is the specialty «management», for which $AVDU_i$ = –12.95 %.

Adequate assessment of the regional labor market by university entrants is provided only to the following educational programs and their groups: «financial management», «personnel management», «technology of electronic multimedia publications and computer technologies and systems of publishing and printing publications», «logistics», «banking case». The value of the validity of demand for them ($AVDU_i$) varies from –1.06 % to +1.04 %.

Excessive reassessment of the needs of the regional labor market by university entrants takes place in the following groups of specialties, educational programs: «information technology», «marketing, advertising and PR, media communications», «tourism, hotel and restaurant business», «International economic relations, international economy», international relations…», «legal regulation of the economy», «customs», «management of the social sphere». The value of the validity of demand for them ($AVDU_i$) varies from +2.02 % to +11.18 %.

Assessment of the validity of the demand by entrants of all HEIs of Ukraine for groups of specialties, educational programs in relation to vacancies in the regional labor market is not fully correct. Because the structure of vacancies was determined only for Kharkiv and adjacent regions. However, as shown by the values of $AVDS_i$ from column 7, **Table 2.13** the validity of the demand of entrants of all HEIs of Ukraine for these groups of specialties, educational programs almost completely coincide with the corresponding indicators of university entrants.

In Ukraine as a whole, entrants significantly underestimate the following groups of specialties, educational programs: «entrepreneurship, trade and exchange activities», «management», «accounting and auditing», «business economics». The value of the validity of demand for them ($AVDS_i$) varies from –1.6 % to –20.6 %. The most underestimated is the specialty «management», for which $AVDS_i$=–20.6 %.

Adequate assessment of the regional labor market by entrants of all HEIs of Ukraine is provided only to the following educational programs and their groups: «economic cybernetics and applied statistics», «banking», «social management», «financial management». The value of the validity of demand for them ($AVDS_i$) varies from –1.45 % to +1.46 %.

Excessive reassessment of the needs of the regional labor market by entrants of all HEIs of Ukraine takes place in the following groups of specialties, educational programs: «information technology», «marketing, advertising and PR, media communications», «personnel management», «tourism, hotel and restaurant business». «International economic relations, international economics, international relations», «logistics», «legal regulation of the economy», «customs». They are currently the most popular. The value of the validity of demand for them ($AVDS_i$) varies from +3.22 % to +11.07 %.

Assessing the needs of the labor market in specialists of certain specialties, taking into account the data on the number of unemployed is objectively extremely important for the management of HEIs, but only a small number of applicants pay attention to them.

Surveys of applicants and their parents show that in our society, the factor of labor market needs now recedes into the background when choosing a specialty and university. The needs of the individual in self-expression, self-affirmation, that is, everyone wants to be significant, are beginning to play a more important role in this process.

At the present stage of development of society in Ukraine, decision-making when choosing a specialty, educational program is not based on the criterion of «price – quality», or «labor market requirements», and a virtual opportunity to express themselves or show others their virtual success.

The desire of the entrant and his/her parents to express themselves, to become more significant in the eyes of others today must be taken into account when conducting career guidance work, forming the image of the university and developing the content and forms of teaching and educational work. We need to hold events that help our future students and their parents assert themselves in the eyes of others.

The pragmatic conclusion for the marketing service of the university is to support the belief of entrants that their chosen popular specialties and educational programs are indeed the most prestigious.

For all other specialties and educational programs (less popular) it is also necessary to focus work mainly not on the possibility of employment, but on the formation of confidence in the community in their prestige. When setting the price for the contract form of education, it is also important to take into account the fact that for «revalued» specialties and educational programs, the price does not play a decisive role for applicants.

The conducted research confirms the relevance of the measures proposed in the author's work [18]:

– for higher education institutions: to constantly monitor the assessment of the popularity of specialties and educational and professional programs, based on the results of which to develop strategic and tactical plans for the promotion of certain specialties; use means of communication that are popular among young people; use content that is close to entrants and may interest them; to involve not only professional marketing agencies for the promotion of higher education institutions, specialties and educational-professional programs, but also the students themselves, which will increase the confidence of applicants and may change their attitude to the place and direction of study; to conduct entrant schools with the use of quests, trainings, business simulations in areas that may interest them as much as possible;

– for public administration: allocate more budget funding for «undervalued» specialties and reduce funding for «overvalued» specialties, which will significantly affect aggregate supply and demand in the labor market; to set higher quantitative competition limits in points for «overestimated» specialties and vice versa for «underestimated» for the period when the labor market will change sectorally from demand-limited to resource-limited for certain specialties.

## 2.3 CLUSTERING OF GROUPS OF SPECIALTIES AND EDUCATIONAL PROGRAMS ACCORDING TO THE CRITERION OF SIMILARITY OF REQUIRED COMPETENCIES

Component 4, these are employed professionals, including the self-employed, but who are trying on vacancies in the labor market. They are described as $P_i\{a, b, c, d, e, f\}$.

It is important for employed professionals to understand the professional and personal competencies required in job advertisements. These specialists are already employed, so it is important for them not just to find a job, but to improve their material support and find more opportunities for self-expression of the already acquired personal and professional competencies. In this context, it is important to cluster specialties, educational programs on the basis of common competencies. No less important is the interpretation of the content of competencies that describe a vacancy in the ads.

For example, as shown in [18], practical communication with employers indicates that the term «experienced PC user» means a competence that takes into account the possession of MS Office, especially its components: Word, Excel, Power Point. This competence is considered absolutely necessary for any employee from the secretary to the top manager. The requirements of the domestic and world labor market, the experience of foreign universities have led to the fact that in Simon Kuznets Kharkiv National University of Economics curricula and the content of the taught disciplines provide continuous computer training for both bachelors and masters. From the first semester of study until the final semester, both theoretical and practical components of the formation of computer competence are provided and implemented within all specialties and educational programs for which specialists are trained at the university.

According to the content of educational disciplines from the curricula, a wide range of software products of different levels of complexity and orientation is used in the formation of computer competence. 49 software products are considered. Their list is given in [18].

The analysis of the specified table shows that Microsoft Office/Office 365 is used for preparation of experts of all specialties.

The following products may be used to train specialists in six or seven specialties: Statistica (statistical calculations); R (programming environment); Business Studio/Ramus Educational/ ARIS Express/Bizagi/BPWin (business process modeling); Microsoft Project (project management).

To train specialists in four or five specialties, the following may be used: Eviews (econometric analysis); MathLab/Scilab/MathCad (applied mathematical programs); 1C Production enterprise management and personnel management; ADOBE (graphics and audio/video packages)/ Sony Vegas Pro; Google applications (online services).

The other 38 software products may be used at the university to train specialists with higher education in one or three specialties.

The cluster analysis conducted by the author [18] provides an opportunity for already employed professionals (they are elements of this component) to assess their computer competencies, especially for specialties that require the possession of really special software products. It is important for them not just to find a job, but to improve their material support and find more opportunities for self-expression and application of already acquired professional competencies.

In addition to computers, advertisements for many specialties require foreign language competencies. The results of the analysis of the demand for language competencies are presented in **Table 2.4**. This component of professional competence is also very important for already employed professionals to make an informed decision about changing jobs.

Unexpectedly low requirements for language competence are presented in **Table 2.4.** In 2021, more than 30 % of ads contained requirements for language competence only in the following specialties: «information technology» (36.4 %), «Technology of electronic multimedia publications and computer technology and publishing systems» (38.5 %), «International economic relations, international economy, international relations» (36.8 %). In other specialties, this percentage was much lower.

However, direct communication with employers indicates that language competence is objectively necessary, especially for those positions that require a higher education employee. Therefore, the university has created conditions for learning a foreign language during the entire period of study for students of all specialties. They have the opportunity to make their own trajectory of their studies so that each school week due to the variable component had 6–8 hours of learning a foreign language during the entire period of study, regardless of the specialty in which they study.

Thus, based on the results of research, it can be concluded that the analysis of ads can not be an exhaustive method of assessing the labor market to identify personal competencies of future professionals.

The management of higher education institutions needs to be in constant contact with employers, which will allow to make informed management decisions on the formation of relevant and priority competencies and patterns of behavior in students of certain specialties to increase their demand in the labor market and image of educational institutions as progressive and professional institutions and training of highly qualified specialists.

# 3 EVALUATION OF POTENTIAL OPPORTUNITIES OF STUDENTS IN STUDY AND WORK


## ABSTRACT

The section presents an analysis of cognitive and emotional characteristics of students and their impact on learning outcomes at the university. The advantages and disadvantages of the functioning of the system of external independent evaluation of learning outcomes (EIE) in Ukraine are formulated.

The possibilities of using the psychological characteristics of entrants, the scores of their external evaluation certificates to assess future learning outcomes and to assess career prospects after graduation have been explored.



## KEYWORDS

Higher education, external evaluation (external independent evaluation of learning outcomes), IQ (coefficient of intellectual development), EQ (emotional intelligence).


University community of Simon Kuznets Kharkiv National University of Economics in its development strategy until 2027 adopted the following interpretation of its mission: «Formation of a patriotic, comprehensively developed, creative personality, capable of self-determination and self-realization, a competent professional for scientific, innovative and practical work in the socio-economic sphere».

In the context of this section we will consider a fragment of the university's mission, which concerns the development of a creative personality capable of self-determination and self-realization.

This raises several fundamental questions:

– How real is the opportunity to form a creative personality for all young people?

– How to assess the potential of young people for self-determination, self-realization and creative activity in a particular field?

– How can you teach a person to increase their abilities to self-determination and self-realization, to manage their emotions and self-motivation?

In the scientific world, there are various methodological approaches for assessing creativity, emotional intelligence (EI) and the so-called coefficient of intellectual development (IQ) or academic ability.

## 3.1 DEFINING THE EMOTIONAL AND INTELLECTUAL PORTRAIT OF STUDENTS

According to the author, the last three decades are characterized by the fact that gradually in scientific thought begins to dominate the leading role of emotional intelligence in the self-realization

of the individual, in his/her life success. A prominent role in shaping this trend certainly belongs to the famous American psychologist Daniel Goleman.

In fact, he combined into a single concept of «emotional intelligence» personality characteristics that were previously considered independently.

Among such characteristics, one way or another, the following are considered: emotional awareness (self-awareness), management of their emotions (emotional self-regulation), self-motivation, empathy, recognition of other people's emotions.

His research at the junction of the two sciences of psychology and neurobiology demonstrated that the emotional part of our brain learns differently than the intellectual. Moreover, unlike IQ, which hardly changes after ten years of a child's life, emotional intelligence depends significantly on practical training in all its components.

However, some emotional characteristics are manifested in early childhood. It's about managing your emotions. In the last century, psychologist Walter Michel conducted the so-called «marshmallow test» for the ability to curb desires. In a group of four-year-old children from teachers and staff at Stanford University, the teacher handed out one marshmallow candy and an alternative was suggested. If the child is patient and does not eat candy for 15–20 minutes while the teacher goes about business, then on its return the teacher will give the child another candy and, thus, it will be possible to eat two candies. Some children could not resist the temptation and immediately ate their treats, and the other part was able to restrain their impulsive actions and received additional treats!

After 12 years, the behavior of all children who participated in the experiment was evaluated by experts. It turned out that those teenagers who resisted the temptation at the age of four were significantly different from the rest of the group. They were persistent in solving problems, behaved more adequately with other people, were independent and confident, deserved the trust of others.

After graduating from high school, children were assessed on standard tests to determine academic ability. Daniel Goleman cites the following data: a third of children who impatiently grabbed candy at the age of four received an average of 524 points for the humanities component of the test and 528 points for the mathematical component; the second third – the children who waited the longest – had average scores of 610 and 652 points, respectively, i.e. in total they scored 210 points more.

Thus, the psychologist concludes, the behavior of four-year-olds during the «marshmallow test» is twice as powerful a prognostic factor for their future assessments for the test of academic ability than their IQ level at four years. Otherwise, the ability to postpone pleasure makes a great contribution to our intellectual potential, regardless of mental development (IQ) and is the basis of emotional self-regulation [21, 22].

Underestimation of the prognostic possibilities of the values of the components of emotional intelligence, in relation to the success of students in learning and, especially, in future work, can be traced in many studies of the author. Therefore, in this paper an attempt is made to eliminate this shortcoming.

Fortunately, the components of emotional intelligence can be improved in the process of learning and practice. That is why it is possible to have a significant impact on the future success of our graduates through the formation of high performance components of EI.

Let's consider the results of testing first-year students of Simon Kuznets Kharkiv National University of Economics according to the method of N. Hall in 2017 and 2020 for individual components of EI. 80–85 % of first-year students took part in testing every year.

The results of the research presented in **Table 3.1** show changes in the components of emotional intelligence in first-year students of the university during this period. The emotional and intellectual portrait of first-year students is changing.

**Table 3.1** The results of the study of the level of EI in terms of components in four school years in percent

| | 2017/2018 | | | | 2018/2019 | | | | 2019/2020 | | | | 2020/2021 | | | | Average values | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Critically low | Low | Average | High | Critically low | Low | Average | High | Critically low | Low | Average | High | Critically low | Low | Average | High | Critically low | Low | Average | High |
| Integral assessment | 9.3 | 59.7 | 40.4 | 2 | 8.7 | 49.5 | 40.2 | 3.1 | 25.8 | 47.6 | 43.4 | 3.2 | 10 | 39 | 41 | 10 | 13.4 | 49.0 | 41.3 | 4.6 |
| Emotional awareness | 8 | 31.7 | 42.7 | 17.6 | 7.2 | 36.6 | 35.0 | 21.2 | 6.2 | 36.2 | 39.1 | 18.6 | 9 | 26 | 39 | 26 | 7.6 | 32.6 | 39.0 | 20.8 |
| Managing own emotions | 37.8 | 38.3 | 19.9 | 3.8 | 38.1 | 41.6 | 16.2 | 4.1 | 34.9 | 44.8 | 16.3 | 4.0 | 34 | 34 | 23 | 8 | 36.2 | 39.7 | 18.8 | 5.0 |
| Self-motivation | 10.2 | 36.1 | 38.1 | 15.4 | 11.8 | 42.1 | 32.6 | 13.4 | 10.6 | 38.2 | 34.5 | 16.7 | 13 | 31 | 34 | 22 | 11.4 | 36.9 | 34.8 | 16.9 |
| Empathy | 6.4 | 29.8 | 44.8 | 18.3 | 7.4 | 35.7 | 35.4 | 21.5 | 6.0 | 32.6 | 40.1 | 21.3 | 9 | 21 | 40 | 30 | 7.2 | 29.8 | 40.1 | 22.8 |
| Recognizing other people's emotions | 9 | 33 | 43.5 | 13.5 | 10.4 | 37.8 | 35.9 | 15.9 | 7.2 | 39.7 | 35.5 | 17.3 | 10 | 28 | 41 | 22 | 9.1 | 34.6 | 39.0 | 17.2 |

The percentage of students with «critically low» and «low» levels remains high, although according to the integrated assessment it decreased from 69 % in 2017 to 49 % in 2020.

In terms of EI components, we also have a reduction in the percentage of first-year students with «critically low» and «low» levels.

More important is the fact that the number of first-year students with a high level of emotional intelligence has increased significantly over the years. According to the integrated indicator – from 2 % to 10 %. In terms of EI components, the smallest (4.2 %) increase was in the management of their emotions, and the largest (11.7 %) in empathy (**Table 3.1**).

We will proceed from the hypothesis that the components of EI are only partially inherited by the child from the parents. The second, more important part, is formed in the child in the process of gaining experience in communication at school, at home and other teams. The observed changes

in the components of emotional intelligence of first-year students indicate that, on average, the external influence on children becomes more positive, or that children come to the university more developed in the emotional and intellectual dimension.

This increase in the number of first-year students with high levels of EI formation gives confidence that the number of successful university graduates will increase.

The first component is «Emotional Awareness»:

1. *Emotional awareness (self-awareness).* Self-awareness or emotional awareness can be interpreted as the ability to have a passive, unbiased view of one's inner state and the ability to evaluate it. If a person can assess its condition impartially at the moment, it is already a significant achievement in the development of his/her EI.

This component of emotional intelligence is formed throughout life, but the most important part of it should be formed during the school period. The results of research of university entrants show that this aspect of the educational process at school is not given the necessary attention.

In terms of «emotional awareness», the number of students with «critically low» and «low» levels decreased from 39.7 % in 2017 to 35 % in 2021.

Unfortunately, this ability is insufficiently developed in our first-year students and, therefore, in the educational component of the educational process it is necessary, especially in the formation of life (soft) competencies, to include in training exercises for the formation of emotional awareness.

The results of the study in the 2017/2018 and 2019/2020 academic years are presented in **Table 3.1**.

The percentage of first-year students with high grades of emotional awareness in these years ranged from 17.6 % to 26 %, which confirms the insufficient level of development of first-year students in this component of EI, but from year to year there is an increase in the number of students with such grades.

Critically low development of this component of EI (**Table 3.1** and diagrams **Fig. 3.1**) is characteristic of 8–7.2 % of students, which almost corresponds to the percentage of students who do not plan to work after graduation and those with higher education not required according to the survey [23].

The formation of a high level of emotional awareness is the first and very important step towards the realization of the next component of emotional intelligence «Managing your emotions».

2. *Manage your emotions.* Studies have shown that «our brains are built in such a way that we are often unable to control either when we are overwhelmed by emotions or what those emotions will be. However, we have some control over how long we feel these emotions» [21].

It is impossible and harmful to eliminate all emotions, but it is necessary to control strong emotions so that they are comparable in time and volume with the circumstances that caused them. The reaction of a mentally healthy person to certain challenges must be controlled and adequate to him. In general, the ratio of positive and negative emotions creates conditions for productive work in order to implement their own plans. The ability to master their emotions has a positive effect on all mental abilities, provides their synergistic interaction to achieve goals.

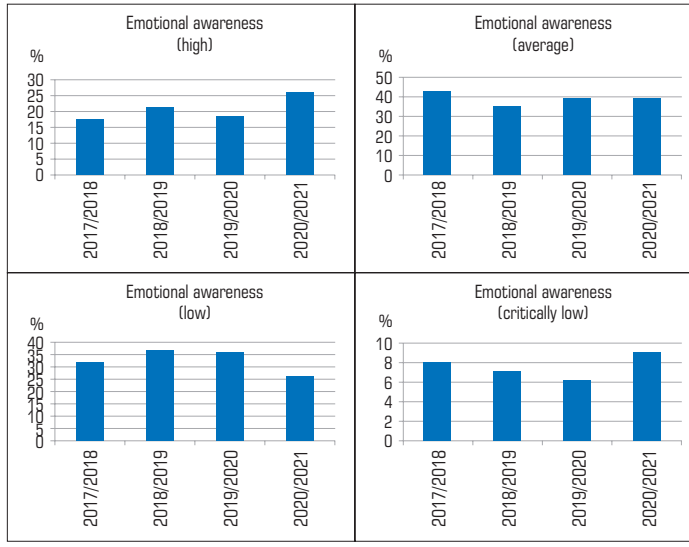



**Fig. 3.1** Diagrams of assessment of emotional awareness of first-year students by school year

In our first-year students the component of EI «management of their emotions» is estimated much lower than the previous component, which is understandable given their lack of experience in responsible communication. They do not yet fully understand the connection between their behavior and the vital consequences for their lives. The percentage of students with a critically low level of development of this component of EI is especially significant. According to our research, the percentage of such freshmen ranges from 34.0 % to 38.1 % (**Table 3.1** and diagrams **Fig. 3.2**).

However, it should be noted that for this component of EI, the number of students with «low» and «critically low» levels decreased from 76.1 % in 2017 to 68 % in 2020. Thus, there is a tendency to reduce the number of first-year students with a low level of mastery of their emotions.

Thus, more than a third of students have not yet realized that their success in life depends significantly on the ability to manage their emotions, to control themselves in everyday life and business communication. Instead, only 3.8–4.1 % of students have a high score on this component. These are students who have already had enough experience and natural abilities to understand the importance of restraining their emotions. It is important to note that the number of students with a high level of this component of EI has almost doubled. This indicates that more mature students came to the university last year.

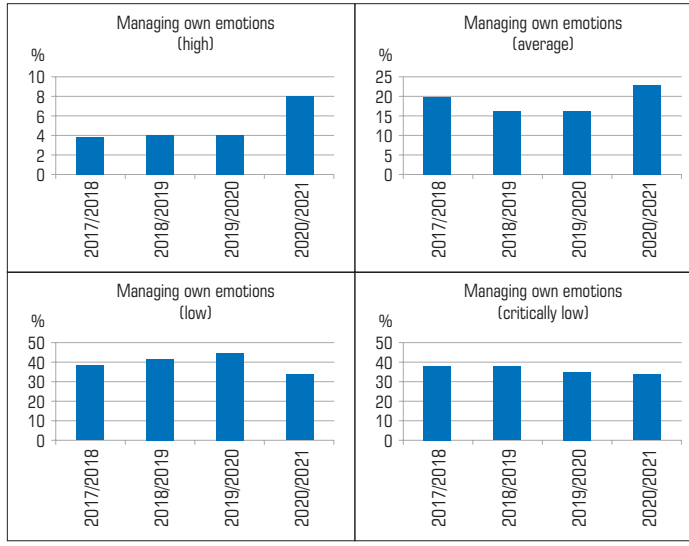



**Fig. 3.2** Diagrams of assessment of the component of EI «management of the emotions» of first-year students on academic years

An extremely high percentage of first-year students with a critically low level of ability to control their emotions confirms the hypothesis of the devastating impact of a rapid reduction in children's contact time through its replacement by contact on social networks.

Therefore, in the educational component of the educational process at the university it is necessary to include in training exercises to develop the ability to manage their emotions. This is especially effective in business games that involve teamwork.

The percentage of students with high and medium grades should be significantly increased by the fourth year, which can provide our bachelors with a strong emotional basis for a successful career.

3. *Self-motivation.* The value of this component of EI is difficult to overestimate for any purpose. The ability of a person to encourage itself, to form his own stimulus, to adjust itself to hard work and to a successful result plays a crucial role in achieving it. Optimism is a prognostic factor for both successful learning and successful work. Thus, this component of EI has two sides. On the one hand, it is optimism and hope for success, and on the other hand, it is the ability to develop a specific plan to achieve results and adjust yourself to make efforts to implement this plan. The pinnacle of self-motivation to study or do a specific job is inspiration. Great masters in various fields of science and art are able to use inspiration in their work.

The research results are presented in **Table 3.1** and diagrams **Fig. 3.3**.

Unfortunately, our freshmen have not developed this ability enough. Although the percentage of students with high self-motivation scores is almost four times higher than the previous component of EI – «Managing your emotions». This percentage ranges from 13.4 % to 22 % and tends to increase from 15.4 % in 2017 to 22 % in 2021. See **Table 3.1** and diagrams **Fig. 3.3**.

The component of «self-motivation» also reduces the percentage of students with low levels. This percentage decreased from 46.3 % in 2017 to 44 % in 2020.

10.2–13 % of students have a critically low level of self-motivation, which is 4–5 % more than the number of students who do not plan to work after graduation and those who do not need higher education according to the survey [18, 24]. These students plan to work and need higher education, but the circumstances at school and in the family are such that they do not have the ability to self-motivation and, therefore, in the educational component of the educational process is needed, especially in the formation of life competencies (soft), include exercises for self-motivation formation in trainings.

Forming a high level of «self-motivation» in students is a very important step towards achieving high results in education and future work.

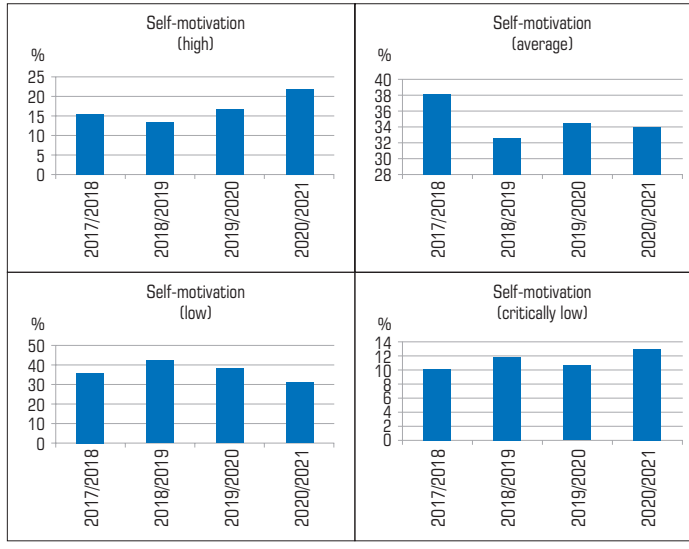



**Fig. 3.3** Diagrams of evaluation of the component of EI «self-motivation» of first-year students by academic years

4. *Empathy.* The basis of empathy is self-awareness. If a person cannot distinguish his own emotions, then all the more it cannot recognize the emotions of other people. The ability to understand other people's feelings through nonverbal cues such as intonation, voice volume, facial expressions, hand gestures and body movements is extremely important in virtually all human activities, including learning. People with such an ability show high emotional adaptation. They gain popularity in the team, have a high level of sociability, easily establish relationships with people of the opposite sex.

As a result of his research, Daniel Goleman concluded that «the results of the empathic ability test almost do not intersect with the scores obtained during the tests to identify academic abilities. The experiment involved 1,011 students: those who showed the ability to nonverbally read the feelings of others were the most popular in their schools and had the highest emotional stability. They also studied better, although their average IQ did not exceed the IQ of children who were less able to decipher nonverbal information. Thus, we can conclude that by mastering the art of empathy, it is possible to increase learning success (or simply make the teacher treat you with more affection). Rational thinking is manifested in words, and emotions are always expressed by nonverbal means» [21].

Thus, we can conclude about the high prognostic value of tests for the development of empathic abilities in assessing the future success of young people in learning and work.

In the first-year students of our university, this component of EI is developed approximately at the level of «Emotional Awareness». The percentage of students with high scores tends to increase from 18.3 % to 30 %, the percentage of students with critically low scores – from 6.0 % to 9 % (**Table 3.1** and diagrams **Fig. 3.4**).

Each person's ability to empathize is closely linked to their ability to recognize other people's emotions. This is an axiom, because it is impossible to imagine a situation when a person who does not know how to appreciate the experience of another will begin to empathize! Why does its sympathize?

5. *Recognition of other people's emotions and the art of social interaction.* Building interpersonal relationships requires the use of non-verbal information to decipher the emotions of other team members, self-control skills and, of course, the ability to demonstrate their emotions!

In any communication, we generate emotional signals that the interlocutors receive. The level of social skill of a person is determined by a dual ability. First, it must have the ability to recognize the emotions of other people, and secondly – the ability to form adequate own emotions with confident control of the signals it sends to others.

Among first-year students of the university only 13.5–22 % of students have high marks for this component of EI. While the percentage of students with a critically low level of recognition of other people's emotions according to research is in the range from 7.2 % to 10.4 %.

However, the positive fact is that during the period from 2017 to 2021 there is a reduction in the number of students with a total low level («critically low»+«low») by 4 % (42–38 %) (**Table 3.1** and diagrams **Fig. 3.5**).

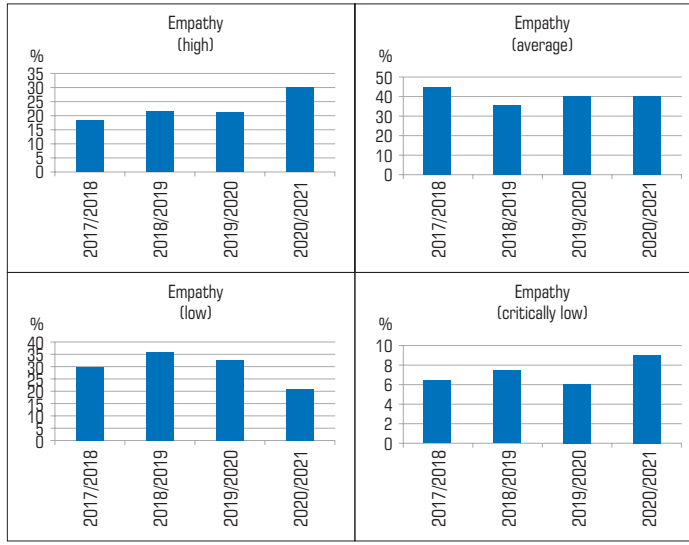



**Fig. 3.4** Diagrams of evaluation of the component of EI «Empathy» of first-year students of Simon Kuznets Kharkiv National University of Economics by academic years

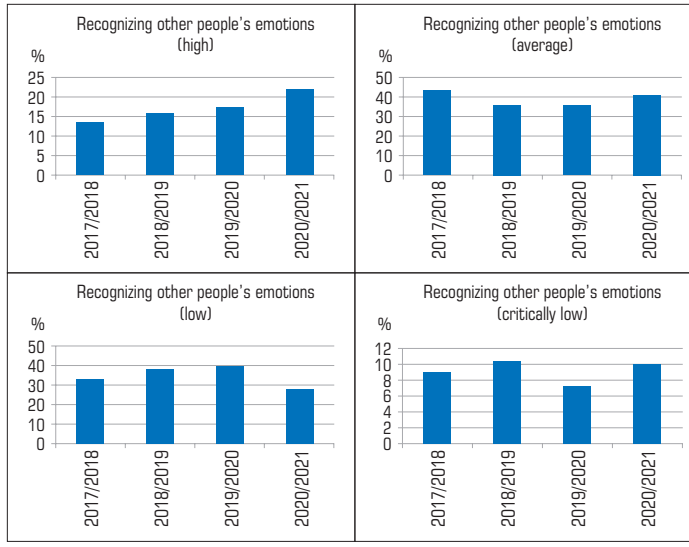



**Fig. 3.5** Diagrams of evaluation of the component of EI «Recognition of emotions of other people» of first-year students of Simon Kuznets Kharkiv National University of Economics by academic years

The formation of components of emotional intelligence in first-year students has not changed for 2017–2020. According to the actual data (**Table 3.1**), there is a slight (3–4 %) increase in the number of students with high scores on all components.

Thus, the average values for the years of research in terms of components of EI are an emotional and intellectual portrait of our first-year students (**Table 3.1**). These values are basic, they assess the community of freshmen who entered our university. The diagrams **Fig. 3.6** provide in a graphic form emotional-intellectual portrait of our first-year student on the components of emotional intelligence.

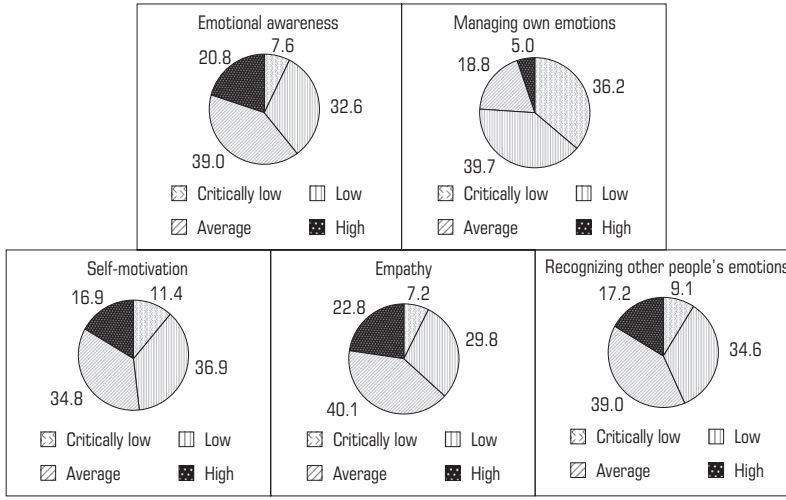



**Fig. 3.6** Graphic representation of the emotional and intellectual portrait of first-year students of the university in 2018–2021

This portrait will certainly change during your studies at the university under the influence of the student community, teachers, a new environment for students. Not only the educational process, but also the interaction with the professional environment during all types of practice has a significant impact on the formation of EI of each student.

In contrast to the coefficient of intellectual development, which mainly depends on the natural data of the individual, the components of emotional intelligence are formed throughout life.

To experimentally assess this impact at the university in June 2021, re-testing of fourth-year students of all faculties was conducted. These are students who entered the university in 2017. About 30 % of students took part in the testing. The results are presented in **Table 3.2**.

● **Table 3.2** Changes in the components of students' emotional intelligence during training

| Indicator | Grade | Average values, % | | | |
|---|---|---|---|---|---|
| | | Critically low | Low | Average | High |
| Integral assessment | 1 grade | 13.4 | 49.0 | 41.3 | 4.6 |
| | 4 grade | 7.5 | 39.9 | 41.8 | 10.8 |
| Emotional awareness | 1 grade | 7.6 | 32.6 | 39.0 | 20.8 |
| | 4 grade | 4.5 | 19.0 | 42.5 | 34.0 |
| Managing own emotions | 1 grade | 36.2 | 39.7 | 18.8 | 5.0 |
| | 4 grade | 40.3 | 34.0 | 20.9 | 4.9 |
| Self-motivation | 1 grade | 11.4 | 36.9 | 34.8 | 16.9 |
| | 4 grade | 12.3 | 36.9 | 34.0 | 16.8 |
| Empathy | 1 grade | 7.2 | 29.8 | 40.1 | 22.8 |
| | 4 grade | 7.5 | 19.8 | 36.6 | 36.2 |
| Recognizing other people's emotions | 1 grade | 9.1 | 34.6 | 39.0 | 17.2 |
| | 4 grade | 9.0 | 27.2 | 41.4 | 22.4 |

According to the integrated indicator EI, the number of students with a «critically low» level decreased from 13.4 % to 7.5 %, while the number of students with a «high» level increased from 4.6 % to 10.8 %. Such changes indicate a positive impact of university studies on the level of EI students.

To determine the structure of influence, consider changes in the number of students with different levels of development for individual components of EI.

First of all, we must state the practical absence of the influence of student life on the two components of EI: «managing their emotions» and «self-motivation». The percentage of students with appropriate levels of these components remained virtually unchanged.

According to the component «emotional awareness», the number of students with levels of «critically low» and «low» decreased from 40.2 % to 23.5 %, while the number of students with a level of «high» increased significantly from 20.8 % to 34.0 %.

In terms of empathy, the number of students with «critically low» and «low» levels decreased from 37.0 % to 20.3 %, while the number of students with «high» levels increased significantly from 22.8 % to 36.2 %.

Similar results were obtained on the component «recognition of other people's emotions». The number of students with «critical low» and «low» levels decreased from 43.7 % to 36.2 %, while the number of students with «high» levels increased from 17.2 % to 22.4 %.

Such results can be explained, firstly, by the expulsion for four years of students who had low learning outcomes, and secondly, by the impact of student life in general and the learning and creativity process.

The lack of changes in the components of «managing your emotions» and «self-motivation» can be explained by:

– imperfection of methods and means of formation of these components of EI in students;

– underestimation of the importance of these components by the students themselves;

– insufficient motivation and competence of teachers.

The peculiarity of these components of EI is that they need to be formed much earlier than the university period.

In any case, at the university level it is necessary to develop measures that will provide our students with a significant increase in the level of formation of these components of EI.

In order to study in more detail the peculiarities of the formation of emotional intelligence of students at the university, research was conducted on the basic motives for higher education, the motives with which freshmen enter university life.

For a long time in society there was a habitual attitude to higher education as a sign of success in life. The realities of modern life show that higher education alone does not guarantee such success, which increasingly influences the motives for choice. Therefore, more and more often in the answers of respondents begins to sound such a motive as «Getting professional training».

Respondents were offered nine motives for higher education, they had to choose no more than three most important for themselves.

For almost half of the respondents, higher education is the path to «Achieve life success» (51.8 %), «Get professional training» (50.8 %) and «Get a good job» (49.2 %).

For a significant part of respondents (42.2 %) – this is a formal motive – «Get a diploma».

The desire to «self-develop» was chosen by 37.6 %.

Social motives – cultural and status aspects of higher education are less significant, they were chosen by 13.9 % and 10.9 % of respondents, respectively.

They did not define this issue for themselves, they do not know why they need higher education – 1.7 %.

Among the open answers (0.9 %) there were: «For a tick», «Commitment to parents», «Because everyone receives» [23]. Thus, according to this survey, 2.6 % of respondents are not motivated to study at all (1.7+0.9).

The fact that 42.2 % of first-year students still noted the need for a diploma does not indicate a lack of motivation to study. Such a high percentage of a formal approach to learning, in the author's view, is due to the conditions of the survey, which provided for the possibility of marking three motives. Therefore, those who plan to achieve success in life and get good training could also note the motive «Get a diploma» (**Fig. 3.7**).

In 2018, another study was also conducted at the university. Respondents: 624 1st year students (54.3 % of the total number). Survey methodology: continuous, anonymous, online survey in the presence of the interviewer. The structure of respondents by place of residence and by gender is presented in the diagram **Fig. 3.8** and **Fig. 3.9**.

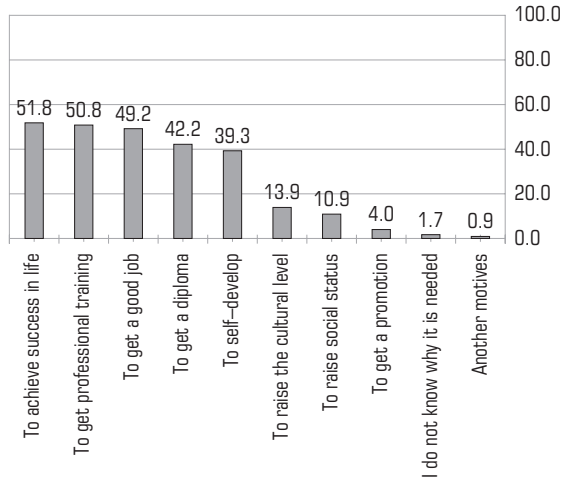



**Fig. 3.7** Motives for higher education, %

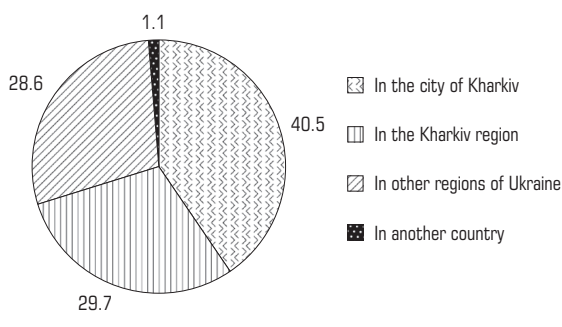



**Fig. 3.8** Place of secondary education, %

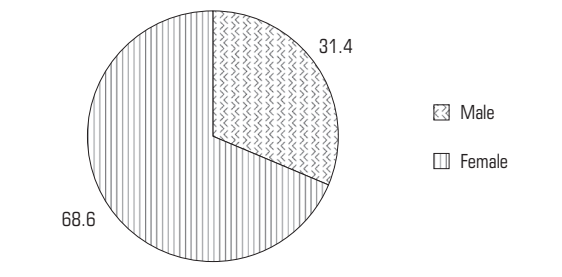



**Fig. 3.9** Distribution of students by sex, %

According to this survey, almost 5 % of respondents said that they do not care where to study and do not care what profession to get. The dependence of such assessments on gender and place of residence at the university has not been identified. It is clear that this part of freshmen has no motivation not only to study, but also to make any effort to shape their future. Perhaps some of them will change their position under the influence of university life.

## 3.2 DEFINITION OF COGNITIVE-INTELLECTUAL AND CREATIVE PORTRAIT OF A STUDENT

Emotional intelligence, of course, plays an important role in the formation of personality, both at the stage of learning and further professional activity. However, underestimating the role of cognitive abilities will be a significant error. The natural abilities possessed by a person should be a reference point at the stage of early career guidance. Some areas of professional activity require special abilities, without which it is impossible to achieve career success.

For example, it is difficult to imagine a successful builder, architect, aircraft designer, engineer with low performance of such components as spatial imagination, spatial generalization, analogies, numerical series!

Although cognitive abilities alone do not guarantee success in professional activities, their presence is required at the level of average and above average scores. This is especially true of professions such as those listed above.

Above average IQs characterize individuals who are successful in business. According to the results of research presented in [22], professionals, marketers, managers, technicians holding senior positions in the world's leading companies have an integrated IQ value of 120 points and above.

Consider the student community of Simon Kuznets Kharkiv National University of Economics where specialists of all levels are trained from bachelors to doctors of sciences in 22 specialties from 12 branches of knowledge presented in **Table 3.3**.

For the university it is very important to form interdisciplinary and interdisciplinary professional competencies, because one of our strategic goals is to train successful professionals, the formation of a comprehensive and harmoniously developed personality capable of self-realization and self-development. Therefore, the formation of methods of prognostic assessments of academic success and professional activity of future students is an urgent task. Such methods will allow for early career guidance of high school students as potential students. In this context, it is important to first research the IQ level of our students.

Research has been conducted regularly for the past fifteen years. Some results of clustering of the student community according to the IQ criterion are given in the author's work [18]. Clustering was performed using the «Statgraphics Centurion» package. The first cluster brings together students with relatively low IQ values, the second group with medium values, and the third group with relatively high IQ values. Some of the results are presented in **Table 3.4**.

**Table 3.3** List of industries and specialties for which specialists are trained at the University

| **Specialties in S. Kuznets KhNUE** | |
|---|---|
| **Field of knowledge (code, name)** | **Name of specialty** |
| 01 Education/Pedagogy | Educational, pedagogical sciences |
| 02 Culture and art | Management of socio-cultural activities |
| 05 Social and behavioral sciences | Economics |
| 06 Journalism | Journalism |
| 07 Management and administration | Accounting and taxation |
| | Finance, banking and insurance |
| | Management |
| | Marketing |
| | Entrepreneurship, trade and exchange activities |
| 08 Law | Law |
| 12 Information technologies | Software engineering |
| | Computer sciences |
| | System analysis |
| | Cybersecurity |
| | Information systems and technologies |
| 18 Production and technologies | Publishing and printing |
| 23 Social work | Social welfare |
| 24 Sphere of service | Hotel-restaurant business |
| | Tourism |
| 28 Public management and administration | Public management and administration |
| 29 International relations | International relations, public communications and regional studies |
| | International economic relations |
| 12 | 22 |

**Table 3.4** The results of clustering students by IQ

| **Cluster No.** | **Average IQ** | | | | **% of changes** |
|---|---|---|---|---|---|
| | **%** | **Points, 2010** | **%** | **Points 2018** | |
| 1 | 33.08 | 82.18 | 4.7 | 71.6 | – |
| 2 | 30.49 | 95.39 | 58.2 | 105.6 | – |
| 3 | 36.43 | 109.68 | 37.1 | 133.0 | – |
| In general | 100 | 96.23 | 100 | 114.2 | 18.7 |

It is obvious that there is an increase in IQ over eight years by almost 19 % (18.7 %), which is much higher than the size of the «Flynn effect», which predicted an increase in this figure in the world by 14 % every ten years. The last century of research on the «Flynn effect» is really active around the world. The published results are often inconsistent, due to the incompatibility of generations, their incomparability in terms of historical conditions of existence, periodization, countries, features of the education system [24–27].

In addition, an analysis of the works of authors such as Jon Martin Sundet from the University of Oslo, Thomas Tisdale from the University of Copenhagen, psychologist Michael Shyer from the University of London, conducted by David Robson in an article on July 12, 2019 «Has humanity really reached the peak of intelligence and rapidly fooling around?» shows another version of the development of intelligence in the modern world [28].

He argues that the stage of growth of human intelligence is coming to an end. If we take the example of Finland, Norway and Denmark, the turning point occurred somewhere in the mid-1990s. After that, the average IQ score began to decline by about 0.2 points each year. Thus, the difference between the generations will be as much as 7 points. As David Robsonon points out, this can be partly explained by the fact that education now stimulates our brain a little less, at least it focuses on other skills.

If we consider the level of secondary education in general in Ukraine, we must state a decrease in learning outcomes in the assessment of foreign institutions. The author's monograph [18] summarizes the estimates of international measurements in the framework of two projects TIMSS and PISA. The deviations of the average scores of our children from the average scores of peers from other countries were considered, although the list of countries that participated in these two projects does not fully coincide. The data are given in **Table 3.5** [18].

● **Table 3.5** Negative deviation of average scores of measurement of learning outcomes of students of Ukraine from average values by countries that participated in projects

| No. | Subjects | TIMSS in points (2007) | PISA in points (2018) |
|---|---|---|---|
| 1 | Math | Minus 38 | Minus 39 |
| 2 | Natural sciences | Minus 15 | Minus 22 |

«Thus, the results of the evaluation of the quality of Ukraine's education system by international organizations within the TIMSS and PISA projects do not provide any strong arguments to hypothesize that the country has conditions for faster growth of population intelligence measured by tests like Amthauer compared to other countries» [18].

Thus, the growth of the average integral value of IQ of first-year students indicates an increase in the attractiveness of the university for young people with high cognitive abilities.

The growth of the average IQ is accompanied by a significant improvement in the structure of the contingent of freshmen (**Table 3.4**). The percentage of students in the first cluster with

lower than average IQ scores decreased by almost 30 % from 2010 to 2018. While clusters of students with medium and high IQ values increased from 67 % to 95 %. Moreover, the average score of the third cluster (higher scores) increased by more than 23 points. In 2010, the cluster with relatively higher scores had an average score of 109.68 (36.43 % of students), and in 2018 it already had 133 points (37.1 % of students).

The fact that 37.1 % of students have an average IQ of 133 points shows the strong potential of our students for successful study and subsequent professional careers. Although, as shown above, cognitive abilities do not guarantee high performance in education or in professional life.

Given the wide range of specialties for which the university trains specialists, it makes sense to consider the student community in terms of IQ components.

The study was conducted in first-year students in 2018 using a test of the structure of intelligence R. Amthauer. The total number of respondents was 864 people: 69.8 % of them were girls and 30.2 % were boys [23].

The results of the study on the subtest «Supplement proposals» show the following: 49.7 % of university students showed high results, 24.2 % of students – above normal, 17.5 % – normal, 6.7 % – below normal, 2.0 % – low (**Fig. 3.10**).

The obtained results indicate that most students have a high level of inductive – linguistic thinking, a wide vocabulary, a relatively high level of awareness in life and science.

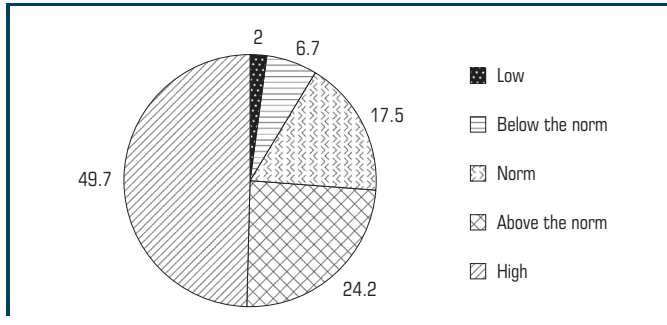



**Fig. 3.10** The results of the subtest «Supplement proposals», %

The results of the study on the subtest «Exception of the word» show the following: the majority of university students (63.1 %) showed high results, 22.2 % of students – «Above the norm», 10.2 % – «Norm», 4.1 % – «Below the norm» and 0.5 % of students – low (**Fig. 3.11**).

The results show that students have a high level of abstraction (finding differences and similarities of objects), classification of concepts and linguistic thinking, which allows a person to completely abstract from the phenomena of reality, using instead of images of phenomena symbolic symbols of these phenomena – words.

The results of the study on the subtest «Analogies»: 30.4 % – university students showed high results, 21.3 % – «Above the norm», 16.2 % – «Norm», 14.2 % – «Below the norm», and 17.8 % – low (**Fig. 3.12**).

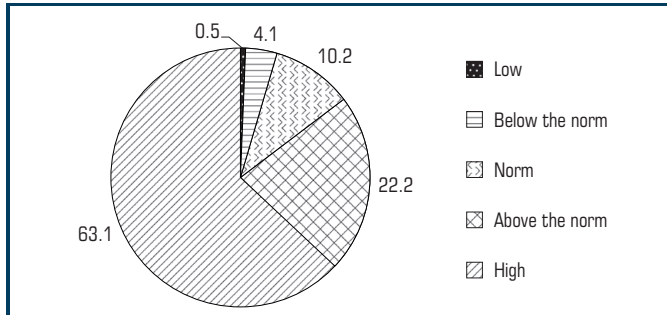



**Fig. 3.11** The results of the subtest «Exception of the word», %

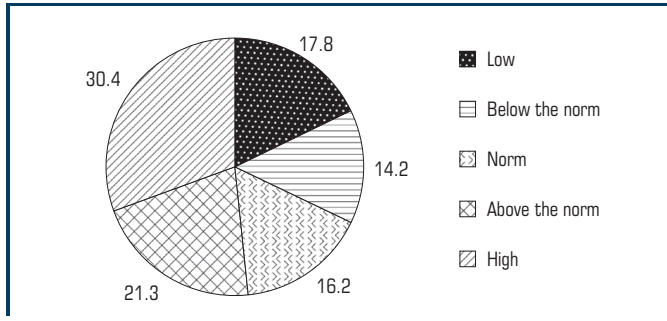



**Fig. 3.12** The results of the subtest «Analogies», %

The results indicate that students have combinatorial abilities, which allows to create new images of objects, transform the image into the end result of a combinatorial problem, flexibility of thinking and the ability to switch attention in the analysis at the middle level. Among verbal subtests, this one received the lowest result. Especially noteworthy is the abnormally large number of students (17.8 %) who performed very poorly, so they have very low combinatorial abilities.

The results of the study on the subtest «Generalization»: the majority of university students (43.2 %) showed high results, 13.9 % of students – «Above the norm», 24.7 % – «Norm», 13.1 % of students – «Below the norm» and 5.2 % of students are low (**Fig. 3.13**).

The obtained results indicate that most students have a highly developed accuracy of logical distribution of information and the ability to generalize, ie the ability to combine, group objects

on the basis of a certain feature. It should be noted that the maximum number of students with «high» and «normal» grades. This indicates that students usually have a high or standard level. Given the format of the task, students are divided into those who quite accurately understand the order of generalization and separation of the most accurate common features and those who can only roughly determine them.

The results of the study on the subtest «Arithmetic problems»: most students (45.8 %) showed high results, 17.1 % of students – «Above the norm», 12.8 % of students – «Norm», 10.0 % of students – «Below the norm» and 14.2 % of students – low (**Fig. 3.14**).

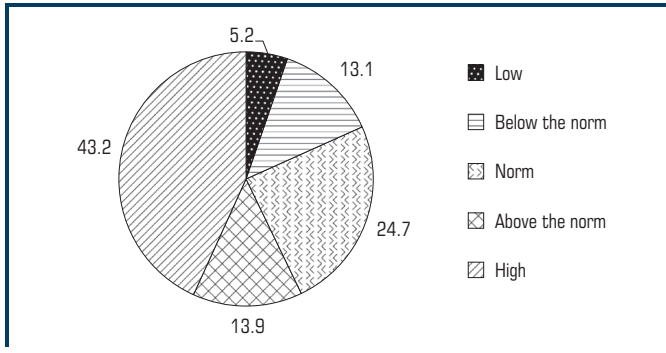



**Fig. 3.13** The results of the subtest «Generalization», %

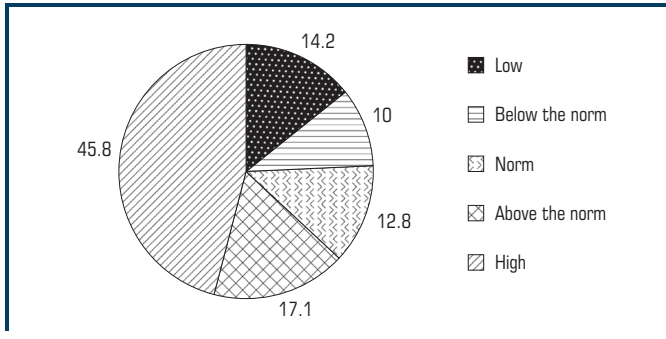



**Fig. 3.14** The results of the subtest «Arithmetic problems», %

The results show that most students have a high level of arithmetic skills, i.e. the ability to quickly perform calculations «in the mind», to use algorithmic calculation procedures, analytical skills and practical mathematical thinking. It should be noted that slightly lower values of low results. That is, there is a clear distinction between students who easily cope with mathematical problems and those for whom they cause significant difficulties.

The results of the study on the subtest «Numerical series»: 31.4 % of students showed high results, 15.7 % of students – «Above the norm» and 17.6 % – «Norm», 17.1 % – «Below the norm» and 18.2 % – low (**Fig. 3.15**).

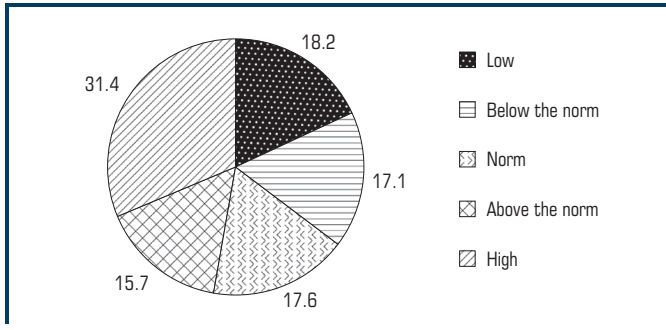



**Fig. 3.15** The results of the subtest «Numerical series», %

The results show that students have inductive, theoretical and mathematical thinking, the ability to operate with numbers and computational skills, they have a medium level of ability to identify new connections, master the general techniques that lead them to solve new problems and to mastering new knowledge. As in the previous subtest, those who easily cope with these tasks and those who have difficulties are clearly distinguished.

The results of the study on the subtest «Spatial Imagination»: 24.8 % of students showed high results, 23.0 % – «Above the norm», 24.5 % – «Norm», 15.7 % – «Below the norm» and 11.9 % – low (**Fig. 3.16**).

The results indicate that students have a spatial imagination, visual – effective thinking and constructive abilities at the average level, with the distribution of students in assessment groups is almost equal.

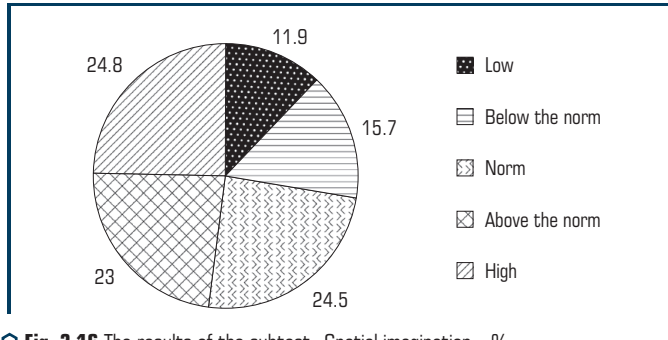



**Fig. 3.16** The results of the subtest «Spatial imagination», %

The results of the study on the subtest «Spatial Generalization» are traditionally low: only 5.1 % received high marks, 9.0 % – «Above the norm», 16.2 % – «Norm», 19.0 % – «Below the norm» and 50.7 % – low (**Fig. 3.17**).

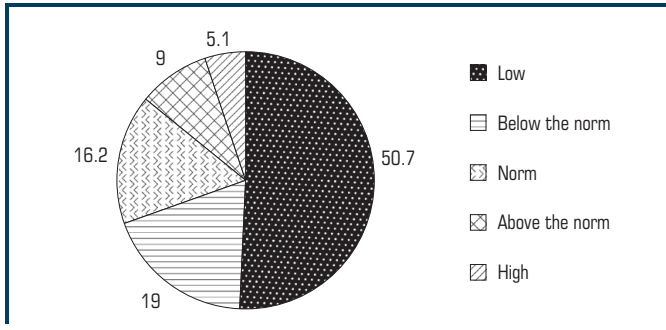



**Fig. 3.17** The results of the subtest «Spatial generalization», %

The results show that visually – effective thinking, the ability to three – dimensional analysis, the operation of spatial images and generalizations in students are developed at a low level.

The results of the study on the subtest «Memory, mnestic abilities»: the majority of students (88.4 %) showed high results, 5.6 % of students – «Above the norm», 2.3 % – «Norm», 1.3 % – «Below the norm» and 2.4 % of students – low (**Fig. 3.18**).

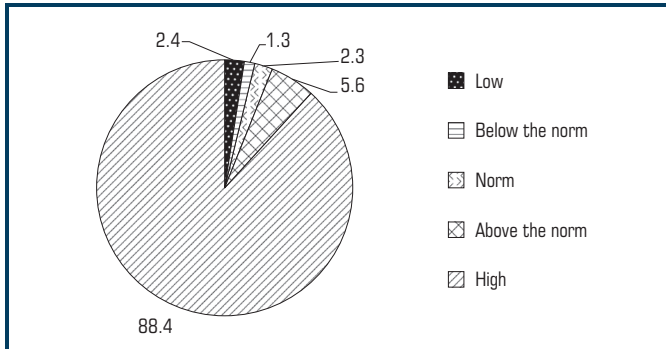



**Fig. 3.18** The results of the subtest «Memory, mnestic abilities», %

The results show that students have developed the ability to work with formal and semantic features of words stored in short-term memory, it is with the amount of short-term memory associated with «mobile intelligence», which allows to quickly solve new problems, namely intelligence depends on this type of memory.

According to the results of the study, the analysis of the level of intelligence (IQ) of first-year students at the university and found that the level of IQ of students is quite high (42.0 % showed «Above normal»).

Among the components of intelligence, students are dominated by verbal thinking (average score – 62.0 % of the maximum, which is «above normal»).

More than half of students have theoretical thinking (52.2 %), practical thinking predominates in 23.6 %, the other 24.2 % do not have a clear advantage.

A detailed analysis of each of the nine subtests and comparison of indicators was performed. It was found that the best results in students on mnestic abilities («High grade» – 88.4 %), as well as on the subtest «Exception of the word» high results («High grade» – 63.1 %).

The lowest results are on the subtest «Spatial generalization» («High grade» received only 5.1 % of students). Also low results are in the subtest «Spatial Imagination» («High score» 24.8 %) and in the subtest «Numerical series» («High score» 31.4 %).

Thus, the cognitive-intellectual portrait of the first-year student of 2018 of Simon Kuznets Kharkiv National University of Economics according to the method of R. Amthauer is graphically presented in **Fig. 3.19**.

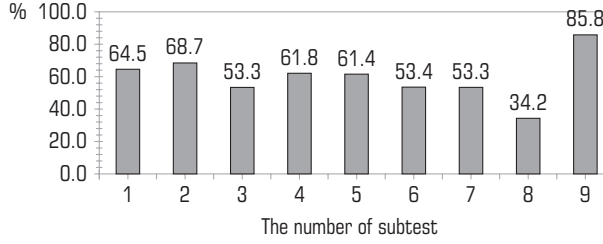



**Fig. 3.19** Cognitive-intellectual portrait of a first-year student of Simon Kuznets Kharkiv National University of Economics (average indicators for the university for each of the subtests, %): Subtest 1 – «Supplement to proposals»; Subtest 2 – «Exception of the word»; Subtest 3 – «Analogies»; Subtest 4 – «Generalizations»; Subtest 5 – «Arithmetic tasks»; Subtest 6 – «Numerical series»; Subtest 7 – «Spatial imagination; Subtest 8 – «Spatial generalization»; Subtest 9 – «Memory, mnestic abilities»

In terms of the methodology for determining the structure of intelligence R. Amthauer, cognitive-intellectual portrait of a first-year student in 2018 at the university can be formulated as follows:

– students are well able to work with formal and semantic features of words that are stored in short-term memory, which indicates intelligence and developed «mobile intelligence», which allows to quickly solve new problems;

– students at a high level have the ability to abstract and classify concepts and linguistic thinking, which allows a person to use instead of images of phenomena symbolic symbols of these phenomena;

– most students at a high level have inductive – linguistic thinking, have a wide vocabulary, a relatively high level of awareness in life and science;

– most students have a fairly highly developed accuracy of logical distribution of information and the ability to generalize, group objects on the basis of a certain feature;

– most students have a high level of arithmetic abilities, i.e. able to quickly perform calculations «in the mind», use algorithmic calculation procedures, analytical skills and practical mathematical thinking;

– students at the middle level have a spatial imagination, visually – effective thinking and constructive abilities and at a low level developed abilities to three-dimensional – geometric analysis, to operate with spatial images and generalizations.

This cognitive-intellectual portrait of the student allows to make the following prognostic assessment of academic performance at the university.

The structure of students' cognitive intelligence allows them to master at a high level the necessary amount of knowledge needed to master the specialties of the university (**Table 3.3**) and to form the necessary professional and life competencies (Soft Skills). Because, the normative requirements to the professional competencies of many specialties of the university do not require students to have a high level of visually effective thinking, the ability to three – dimensional analysis, the operation of spatial images.

A comparison of cognitive-intellectual and emotional-intellectual portraits of our first-year students shows that against the background of high potential cognitive characteristics, students have insufficient development of self-motivation and management of their emotions. This shortcoming can hinder the successful mastery of specialties.

As for a successful professional career, most students have great cognitive potential, but only 4 % of them know how to control their emotions. Thus, only they have a real chance to achieve significant success in the profession.

However, of course, our first-year students have four years to develop the ability to manage their emotions, increase the ability to recognize the emotions of their colleagues, increase self-motivation. Therefore, one of the main tasks of the university is to help its students to form such an emotional and intellectual portrait that will ensure their successful future. Only the development of emotional intelligence on the basis of significant cognitive potential can ensure a successful career!

An intellectual portrait of a student would be incomplete without an assessment of its creative component. The study was conducted with first-year students from the same sample as for the components of IQ. The technique of creativity of E. Torrens which diagnoses creative abilities was used. E. Torrens test – most often used in psychological practice as a standardized tool for measuring creative thinking. The test allowed to evaluate some creative abilities such as: flexibility and originality. The results for 2018 are presented in [18].

We will proceed from the following definitions – «Creativity is the ability to find unexpected, non-standard, original ways of solving problems of various kinds».

Creativity increases adaptive capacity in everyday situations, especially in cases where the usual methods of action are ineffective. It is necessary to make breakthroughs and discoveries, to achieve a qualitatively different level compared to existing standards in educational and professional activities.

Flexibility of thinking – is revealed in the ability to be free from accepted stereotypes and ways to solve problems of any content and level, quickly change their actions when the situation changes, quickly switch from one way of solving behavior to another, to diversify attempts to solve a problem or task and thus find new ways to solve them faster. Flexibility is determined by the number of different categories of answers, to determine which can be used as the pictures themselves and their names (which sometimes does not match).

Originality of thinking is a manifestation of a high level of creative abilities, which indicates non-standard thinking and deviation from the conventional.

According to the subtest creativity (flexibility) the following results were obtained:

– flexibility – 8.1 points (out of 10 maximum points);

– originality – 9.4 points (out of 20 maximum).

As can be seen in **Fig. 3.20** assessment of creativity (flexibility) of students is quite high («High level» – 49.3 %, «Above the norm» – 41.4 %).

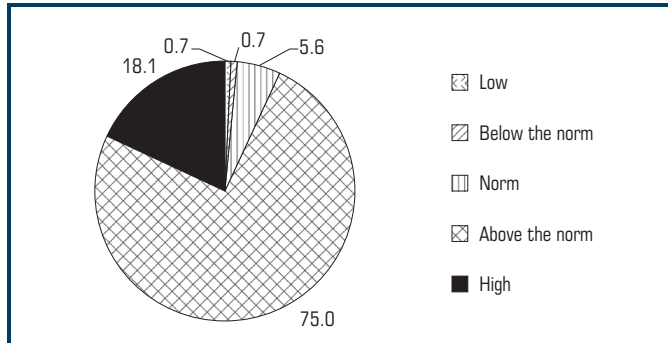



**Fig. 3.20** Distribution of students by level of creativity (flexibility), %

According to **Fig. 3.21** assessment of creativity (originality) of university students is at the average level («Norm» – 42.2 %), slightly shifted to the bottom (grades «Below the norm» – 31.3 %, «Above the norm» – only 18.2 %).

Thus, first-year students add to their cognitive-intellectual and emotional-intellectual portraits an extremely high level of creativity in the subtest «flexibility». Grades: «High level» and «Above normal» received 90.7 % of our first-year students. However, according to the subtest, the

«originality» of the assessment is much lower. Only 19.6 % of students received grades «High» and «Above normal». These indicators do not reduce the potential of university students, as the regulatory requirements for specialists in our university do not require a high level of originality. Such requirements are usually inherent in art specialties.

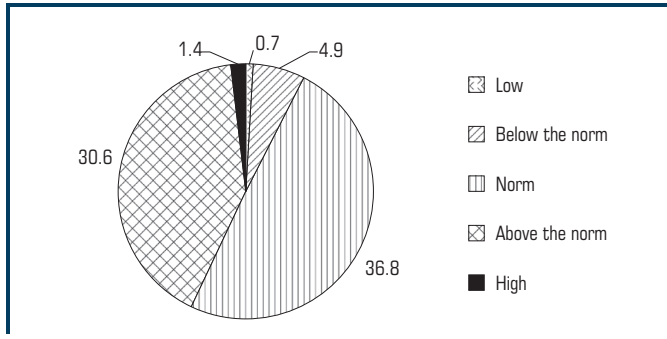



**Fig. 3.21** Distribution of students by level of creativity (originality), %

Student life and the learning process have somewhat changed the results of testing. Comparisons of test results to determine the creativity of first-year and fourth-year students are presented in **Table 3.6.**

**Table 3.6** Change of flexibility and originality during training, %

| Level | Flexibility | | Originality | |
|---|---|---|---|---|
| | 1 grade | 4 grade | 1 grade | 4 grade |
| Low | 0.5 | 0.7 | 6.8 | 0.7 |
| Below normal | 1.4 | 0.7 | 31.3 | 24.9 |
| Normal | 7.4 | 5.6 | 42.2 | 36.8 |
| Above normal | 41.4 | 75.0 | 18.2 | 30.6 |
| High | 49.3 | 18.1 | 1.4 | 1.4 |

We have results on two tests. First, consider the indicators on the subtest «flexibility». The level of «Low» and «Below normal» in fourth-year students is almost no different from that of freshmen (1.9–1.4 %). However, the number of fourth-year students with levels «Above normal» and «High» is greater than that of first-year students (**Table 3.6**). The fourth-year students have 93.1 % while the first year students have 90.7 %.

According to the subtest «originality», the number of fourth-year students has a level of «Low» and «Below normal» 25.6 %, while the number of first-year students with the appropriate values is 38.1 %. Thus, the number of low-level students by the fourth year decreased by 12.5 %.

The number of fourth-year students with levels «Above normal» and «High» is much higher than that of first-year students (**Table 3.6**). The fourth year has 32.0 % while the first year students have 19.6 %.

Such indicators of the dynamics of creativity are explained mainly by the expulsion for four years of students who had low learning outcomes, the impact of the learning process and creativity.

The study of the student community aimed to assess the possibility of predicting the success of training and professional work at the stage of early career guidance. The first important learning outcomes for students are External independent evaluation. This began to play a particularly significant role in the life of each student, when a competitive score is formed on the scores of the external evaluation certificates when entering the external evaluation (since 2008).

Thus, assessing the impact of personality characteristics on the number of points of external evaluation certificates in the Ukrainian language and literature and mathematics is the first step to justify the possibility of these forecasts.

The integral values of IQ and EI of each individual are considered without taking into account the structure of their cognitive-intellectual, emotional-intellectual portraits and creative potential.

The first results were presented in the author's monograph [29]. At the university, regardless of the faculties at that time (2009–2011), the coefficient of intellectual development of students' IQ had a correlation coefficient of 0.42 with points of certificates in Ukrainian language and literature and 0.412 – with points of certificates in mathematics. Regarding the value of EI and the level of creativity, they had correlation coefficients that were not statistically significant with the scores of certificates in the Ukrainian language and literature and the scores of certificates in mathematics.

The results of research in 2016–2019 gave the following results.

Applicants with a different set of external evaluation certificates entered the university. External examinations in mathematics were not required for some specialties. They could be replaced by certificates either from a foreign language or from the history of Ukraine. The paper [18] examined a sample of 550 people who studied at the university using the certificate of external examination in mathematics (main group), the correlation coefficient between the number of points of this certificate and is equal to 0.4223. This value indicates a positive correlation between these values. This means that the higher the university student's rate of intellectual development, the more it has points in the external examination in mathematics. This result corresponds to the size of the correlation coefficient obtained in the studies of 2010–2011 (0.412).

The use of multifactor regression analysis allowed to assess the dependence of scores in the certificates of external evaluation in mathematics (*ZMAT*) on the coefficient of intellectual development (*IQ*), level of creativity (*CL*), level of emotional intelligence (*EI*):

$ZMAT = F(IQ, CL, EI)$,

$ZMAT = 84.31 + 0.572IQ$,

$R^2 = 0.185$,

$F = 135.37$,

$DW = 1.846$.

Thus, the scores in the external evaluation certificates in mathematics (*ZMAT*) depend only on the coefficient of intellectual development (*IQ*) and do not depend on the level of creativity (*CL*) and the level of emotional intelligence (*EI*). The last two influencing factors were not significant according to statistical criteria.

The coefficient of determination shows that 18.5 % of the variability of scores in the external evaluation certificates in mathematics (*ZMAT*) depend only on the coefficient of intellectual development (*IQ*). Of course, this is a small part of the variability, so further research is needed to find out what other factors affect the number of points in the external evaluation certificates in mathematics.

Thus, the influence of emotional intelligence and level of creativity on the number of points in the external evaluation certificates in mathematics is not established. Perhaps this is due to the insufficient development of EI in first-year students at our university.

Examples given in [21, 22], substantiate the significant impact of EI personality on learning outcomes and professional activities. However, with regard to the impact on learning outcomes in high school, the author's calculations given in this section and other works refute this statement! Perhaps the impact of the level of emotional intelligence and creativity on the results of university studies will be more significant and can be recorded by quantitative methods.

Thus, the influence of the components of cognitive-intellectual, emotional-intellectual portraits of individuals and their creative potential on the success of learning in secondary school was assessed. In fact, the influence of these indicators on the number of points in the external evaluation certificates was studied.

The influence of the components of cognitive-intellectual, emotional-intellectual portraits of individuals and their creative potential on the success of university studies is further investigated.

In general, the ability to learn can be assessed as the speed and quality of assimilation by a particular individual of a certain amount of knowledge, skills and abilities. In real life, it is important to assess the ability to learn personality both in a certain range of fields of knowledge and specialties, within which professional competencies are formed, and in the field of interpersonal relationships.

In HEI, as a rule, in the best case, the quality of performance of this or that professionally-oriented task is estimated, in the worst case – the quality of translation or, in general, reproduction of educational material is estimated. Assessing the success of the formation of professional and personal competencies of each student in the process of studying at the university in each discipline is decided individually, they are a separate problem. Issues of assessment of learning outcomes are widely discussed in the scientific literature.

For example, in the article [30] the works of Ukrainian and foreign authors who have devoted their research to the study of control and evaluation of student learning outcomes are analyzed; coverage of the principles of formative assessment and features of the formation of distance learning assessment tasks.

Particular attention is paid to the development of the author's methodology for assessing academic achievement. The content of Bloom's taxonomy levels is discussed, as well as the explanation of the types of activities for the system of evaluation of the results of practical tasks in the discipline «Algorithmization and programming».

Discussion of different approaches and methods of assessing learning outcomes is not the subject of this paper. Therefore, for the quantitative evaluation of learning outcomes in this study adopted an evaluation system used at the university. This is a cumulative 100-point system. The average final session scores of each student during the first three courses of study (*SS*) were used.

As factors that determine the success of university studies in the work of the author [18] proposed the following:

– intellectual development coefficient (*IQ*);
– level of creativity (*CL*);
– level of emotional intelligence (*EI*);
– competitive score (*CS*);
– the number of points of the external independent evaluation certificate in mathematics (*ZMAT*).

The first three factors are not in doubt, especially since their impact on school performance has already been defined above.

The fourth factor is the «Competitive score», the method of calculation of which varies from year to year, but in general it takes into account the scores of external independent evaluation of three competitive subjects with some weights, certificate score, regional and industry coefficients. Depending on the size of the competition score, the entrant may or may not be recommended for enrollment in the budget form of education. In addition, too low *CS* values can block the possibility of enrolling an entrant to study even under contract. This applies to specialties for which a minimum limit for *CS* has been set.

Given the objectivity of the external independent evaluation scores, this indicator may indeed be to some extent an individual's ability to learn, as it aggregates assessments from a variety of subjects. Compulsory subjects include Ukrainian language and literature and two more electives. These can be physics, chemistry, history, geography, mathematics.

Regarding the fifth factor – «the number of external independent evaluation points in mathematics», it can be argued that its use as an assessment of academic ability has already been proven above in relation to schooling.

According to the author, mathematics occupies a special position in the list of primary disciplines. Its study forms a person's logic and consistency of thinking, a sense of necessity and the ability to justify their judgments and conclusions. Thus, if the entrant has high scores in the external independent evaluation in mathematics, it characterizes it as a person who is able to think logically and conclusively. Such a characteristic is essential for the success of training in almost any field of knowledge. Therefore, external independent evaluation scores in mathematics are offered as one of the indicators influencing the ability to learn.

First, we calculate the correlation coefficients between the success rate of university studies and each of these factors (**Table 3.7**).

For the current calculations, we assume that if the value of the correlation coefficient (*Corr*) is greater than or equal to 0.3, it is impractical to ignore the relationship between the indicators, and if it is greater than 0.7, we will assume that ]such a relationship is strong. When the *Corr* value is more than 0.9, the connection is superpowerful and close to functional.

● **Table 3.7** Correlation coefficients between learning success (*LS*) and with indicators characterizing the ability to learn

| Number of students, persons | *IQ* | *ZMAT* | *KB* | *CL* | *EI* |
|---|---|---|---|---|---|
| 550 | 0.2774 | 0.5715 | 0.6886 | 0.1682 | 0.0194 |

Calculations confirm the lack of influence of the level of emotional intelligence on learning success. The correlation coefficient between learning success and *EI* is 0.0194. Thus, this factor does not affect the success of education not only in secondary school but also at university. The influence of the student's level of creativity also does not affect the final learning outcome.

According to these calculations, the competition score has the greatest impact. The correlation coefficient of *CS* with *LS* is equal to 0.6886. However, the internal relationships between *IQ*, *ZMAT* and *i* must be taken into account.

Therefore, we apply multifactor regression analysis and build a regression model of the dependence of learning success (*LS*) on the level of emotional intelligence (*EI*), *IQ*, competitive score (*CS*), creativity (*CL*) and the number of points of the external examination in mathematics (*ZMAT*):

$$LS = F(EI, IQ, CS, CL, ZMAT),$$

$$LS = 19.3879 + 0.0019EI - 0.0054IQ + 0.365CS + 0.091CL - 0.029ZMAT,$$

in standardized variables:

$$t_y = 0.0068t_{EI} - 0.0104t_{IQ} + 0.7483t_{CS} + 0.047t_{CL} - 0.0736t_{ZMAT},$$

$$R^2 = 0.4783,$$

$$F = 99.75,$$

$$DW = 1.823.$$

The coefficient of determination shows that 47.83 % of the fluctuation or variability of student achievement (*LS*) is due to changes in the values of the factors used in this model. This indicator can be interpreted as a statistical assessment of the quality of the model.

The rest of the *LS* variability depends on factors that are not taken into account in this model. The values of the Fisher and Darbin-Watson criteria indicate that the model is adequate and statistically qualitative.

The level of student performance at the university is influenced by factors according to the following rating: competitive score (*CS*), score in their certificate in mathematics (*ZMAT*) (reciprocal), creativity (*CL*), *IQ* (reciprocal), emotional intelligence (*EI*).

The equation of regression of academic performance of university students only from significant factors has the form:

$$LS = 20.6839 + 0.3358CS,$$

$$R^2 = 0.4741,$$

$$F = 494.04,$$

$$DW = 1.839.$$

Exclusions from the model of insignificant factors did not change the percentage –0.42 % (47.83–47.41 %) of student success rate (*LS*). Thus, the quality of the model has hardly changed.

The values of the Fisher and Darbin-Watson criteria indicate that the model is statistically qualitative.

This model can be used to predict the success of university entrants. For example, if an entrant has a competitive score of 180, then the projected average score of his studies at the university will be 81.1279 (180·0.3358+20.6839) [18].

In 2011, similar studies were conducted on the student environment of the university. 895 students passed the test. In the work [31] a multifactor regression analysis was applied and a regression model of learning success (*LS*) dependence was built from the coefficient of intellectual development (*IQ*), points of certificates of external independent evaluation in Ukrainian language

and literature (*ZL*), number of points of certificate of external examination in mathematics (*ZMAT*) and average points of certificates of complete secondary education (*A*):

$$LS = 0.095IQ + 0.336ZL + 0.205ZMAT + 0.279A,$$

$$R^2 = 0.587,$$

$$F = 314.9,$$

$$DW = 1.564.$$

The values of the Fisher and Darbin-Watson criteria indicate that the model is statistically qualitative.

The coefficient of determination shows that 58.7 % of the fluctuation or variability of student achievement (*LS*) is due to changes in the values of the factors used in this model. This model can also be used to predict the success of a particular student.

Thus, this model confirms the insignificant influence of *IQ* on the success of students at the university in the case when the scores of external independent evaluation certificates are used together with this indicator.

However, in a direct study of the relationship between student learning outcomes and their *IQ*s in 2010 and 2011, the correlation coefficient was 0.427 throughout the period. This value suggests that there is a statistical relationship between academic performance and *IQ*, but further research is needed to determine the strength of this relationship [29].

In general, studies have shown the following:

– the integrated indicator of the development of emotional intelligence of the individual, calculated by the method of *N*. Hall, on average does not have a statistically significant effect on the success of learning the individual in high school and university. If we consider the structure of the emotional and intellectual portrait of each student separately, it is possible that the outstanding values of such components as «self-motivation» and «recognition of other people's emotions» will allow to achieve outstanding academic success if *IQ* is above average;

– the integrated indicator of creativity, calculated according to the method of *E*. Torrens, which diagnoses creative abilities, also does not have a statistically significant effect on the success of learning, neither at school nor at university. However, each individual has their own structure of creativity. Therefore, if a particular student has a super high level of originality and flexibility, and in combination with high values of such components of EI as «self-motivation» and «recognition of other people's emotions», it can achieve outstanding learning, but with an *IQ* above average;

– the coefficient of intellectual development, calculated by the method of assessing the structure of intelligence R. Amthauer (*IQ*) has a statistically significant effect on learning success. Such influence is especially noticeable at adequacy of structure of a cognitive-intellectual portrait of the concrete student to requirements of a concrete specialty. For example, if

a student has an *IQ* much higher than the average, but in the structure of his cognitive-intellectual portrait is a weak point of visual – effective thinking, the ability to three-dimensional analysis, operation of spatial images and generalization, then expect to succeed in learning design specialties are not worth it.

The most valid for predicting the success of training was a competitive score. Its level depends on the cognitive-intellectual, emotional-intellectual portraits and the indicator of creativity of each individual, but is additionally determined by something that is not detected by the methods that have been considered.

Learning success cannot be an end in itself. This is only the first step. To achieve success in life requires successful self-realization of a particular individual in the labor market, which is impossible without the acquisition of various components of integral competence. These include, for example, personal competencies such as «sociability», «responsibility», «activity and energy», «result orientation» and other soft skills.

In the process of studying at the university, the formation and improvement of personal competencies is carried out within the «serious» games, the development of team course and diploma projects. However, the assessment of the degree of mastery of these personal competencies in universities is almost not engaged, because they are not directly measured, but are manifested indirectly.

Ultimately, the success of the formation of these personal competencies can be assessed in the labor market when university graduates start working, but a preliminary assessment can be obtained in the process of practical training of students on the basis of practice and in the university staff.

## 3.3 THE PROBLEM OF SELECTION FOR TRAINING IN THE HEI AND THE IMPLEMENTATION OF THE STATE ORDER

The problem of selection of entrants to study at the University (HEI) is still relevant and should be based on the results of marketing research as the demand for certain specialties and labor market supply for certain positions and requirements for them.

Although a lot has been done over the last 10–15 years to enable capable individuals to enter the HEI budget form of education. The national competition, which was introduced during the distribution of budget places between entrants and the HEI, solved many problems that existed in the past. This approach is a really big step forward in improving the quality of training, because it, this quality directly depends, in particular, on which applicants will become students.

The introduction of the current system of enrollment in the HEI and the distribution of the state order between the HEIs allowed:

– eliminate suspicions of biased entrance exams;

– restore children's faith in justice;

– adjust them to the development of their lives by their own work and not to find ways to get inflated grades;

– form in parents the desire to provide children with quality education, rather than overestimation;

– significantly reduce the impact of administrative intervention in the process of assessing students' knowledge.

However, the introduction of a new system of enrollment in the HEI and the system of distribution of public procurement between them did not provide the expected increase in the quality of education. This is evidenced by the results of the assessment of the level of secondary education in Ukraine by international institutions, as presented in the previous section. In addition, a comparison of the average scores of external independent evaluation certificates in mathematics and Ukrainian language and literature in 2008–2009 and 2018–2019 shows a decrease in test results by 7–8 % (**Table 3.8**). Thus, if we reject the possibility of complicating tests in these subjects over the past ten years, we have a decline in the quality of secondary education!

● **Table 3.8** Average values of external evaluation scores in mathematics and Ukrainian language and literature by years

| Subjects | Average score | | The average score for 2008–2009 | Average score | | The average score for 2018–2019 | Changes in the average score |
|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | | 2018 | 2019 | | |
| Math | 151.797 | 150.5440 | 151.1705 | 139.936 | 139.4690 | 139.7025 | –8.2 % |
| Ukrainian language and literature | 150.849 | 150.379 | 150.614 | 141.614 | 140.744 | 141.179 | –6.7 % |

In the work [18] methods of mathematical statistics conducted a detailed analysis of the scores of certificates of external evaluation in mathematics and Ukrainian language and literature from 2008 to 2019 in Ukraine as a whole and by region.

The analysis of test results is based on the hypothesis that the student's ability to learn and use knowledge within a discipline is a stochastic quantity, which is formed under the influence of many different factors and therefore characterized by a normal distribution law. In general, any stochastic quantity that is formed under the influence of many multidirectional factors and does not have in its formation the purposeful influence of any deterministic factor, is distributed according to the normal law.

That is, it can be argued that if there is no external targeted intervention in the process of assessing students' ability to acquire and use knowledge, the grades obtained by students in the testing process should be distributed according to normal law.

Thus, the data of certificates in 2008–2009 are in some sense basic. This is the first two years when the introductory campaign throughout Ukraine was conducted on the basis of

an external independent evaluation (EIE). These are the most significant results of the EIE, as in these years the vast majority of entrants and HEIs were on an equal footing in relation to the accrual of points in the certificates. The level of training in high school is taken as basic. It will count down.

It is important to note that until 2008, the issue of admission to the HEIs was not clearly linked to the quality of the applicant's training, as it was possible to resolve it administratively, organizationally or financially.

Therefore, the beginning of a mass external independent evaluation and the determination of test results by the official criterion for enrollment of HEI entrants in the 2008 was met ambiguously by society. Many parents and entrants did not believe that it was impossible to adjust the scores of the external independent evaluation, which means that the results of the selection for the external independent evaluation, by administrative, corporate and financial methods. This was especially strange for representatives of the authorities and law enforcement agencies. However, the process of enrolling entrants in the HEI went smoothly.

For example, the distribution of scores of certificates in mathematics in 2008 had the form shown in **Fig. 3.22** [18].

Calculations show that, according to the Kolmogorov-Smirnov criterion, the hypothesis of a normal distribution law has not been confirmed. This means that this stochastic quantity is formed not only by a large number of random variables that are independent of each other, but also by some non-random factors.

However, the graphical representation of the distribution of the stochastic value «scores of EIE certificates in mathematics» shows some similarity to the normal, which shows the statistical homogeneity of the entrant environment in terms of scoring EIE in mathematics. In other words, there is a slight influence of non-random factors on the entry of entrants of certain points. In the first year of the introduction of enrollment in the EIE, in accordance with the results of the EIE, entrants were almost all in the same conditions for gaining test scores.

After the introduction of a new system of selection for study in the HEI, the issue of quality training of entrants has become very important. Motivated parents and students faced the problem of finding a school with highly qualified teachers or suitable tutors. Not all families can solve this problem. Thus, since 2008, a powerful non-random purposeful factor begins to form, which influences the formation of the stochastic value «scores of EIE certificates». Gradually, a subset of entrants is formed, which receives an additional opportunity to deservedly receive higher scores. For this subset of entrants, the law on normal distribution is certainly not revoked, but the average number of external evaluation points for this subset of entrants will be higher than that shown by entrants from another subset, consisting of those who, for one reason or another, did not receive access to the best teachers and tutors. The distribution of points of external examination certificates of these entrants will also be subject to the normal law, but with parameters that differ from those that characterize the distribution of the first subset of entrants.

The formation of these subsets is not carried out under the influence of random factors. There are purposeful non-random processes that destroy the homogeneity of the community of entrants, including:

– purposeful selection by parents for their children of schools where effective teachers work;

– providing their children with tutors who work with them in parallel with schooling.

The connection of these factors implies a high motivation of parents or relatives. And then they form a non-random community of students who have the best conditions for preparation for external independent evaluation. This community is heterogeneous in its cognitive abilities and motivation, so the test results will, of course, also is a stochastic value, which is subject to the normal law of distribution of points of external independent evaluation certificates with their parameters.

One of the significant factors in the deformation of the homogeneity of the community of entrants is the combination of indifference, passivity, demotivation of parents and students. This community is also heterogeneous in its cognitive abilities and the test results will also be a stochastic quantity with a normal distribution law. However, despite the indifference to learning and demotivation, some entrants from this community may get high scores, but on average they will not score high.

One of the main parameters of the distribution law and, especially, the normal distribution is the «average value of a random variable», for which the probability is greatest. In our case, it is a «score of EIE certificates» in the relevant subject, which is most often received by entrants in this group. Thus, for each of the above subsets has its own «average value of the scores of certificates of external independent evaluation», which determines the «polyhortality» of histograms, polygons and frequency distribution curves of this stochastic quantity. As an example, the scores of EIE certificates in mathematics in 2019 were analyzed (**Fig. 3.23**) [32].

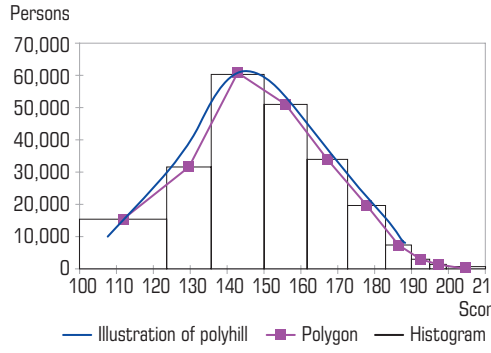



**Fig. 3.22** Graphic representation of theoretical and empirical frequencies of distribution on intervals of points of external examination in mathematics in Ukraine in 2008

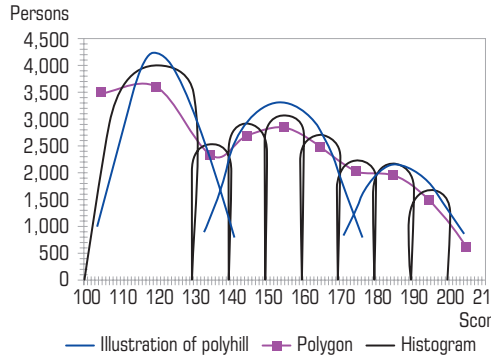



**Fig. 3.23** Illustration of the polyhortality of the law of distribution of the stochastic quantity «points of external examination certificates in mathematics» in 2019

The graphs obviously show a stratification of the entrant community. This is especially evident when comparing the graphs of the distribution of scores of external independent evaluation certificates in mathematics in 2008 (**Fig. 3.22**) and their distribution in 2019 (**Fig. 3.23**). For certificates in 2019, the hypothesis of a normal distribution law is not only confirmed, according to the Kolmogorov-Smirnov criterion, but in general the distribution graph loses the shape of the Gaussian curve.

Based on the calculations of the work [18], three subsets of the community of entrants are selected and their parameters are presented in the form of **Table 3.9.**

**Table 3.9** Parameters of subsets of entrants, according to the scores of the external independent evaluation in Mathematics in 2019 [32]

| Clusters | Number of entrants, persons | Average score of certificates |
|---|---|---|
| First | 5,066 | 185 |
| Second | 10,724 | 155 |
| Third | 8,796 | 118 |

The main positive result of the introduction of a new system of admission to the HEI and the distribution of public procurement is, in the author's opinion, that the mechanism of self-organization was launched and all efforts of motivated parents are aimed at preparing their children to successfully complete test tasks. This means that the child does not expect personal, illegitimate

preferences, but works intensively on mastering the material, improves his ability to concentrate his efforts on achieving the result.

However, the focus on the successful completion of test tasks has a significant side effect. The fact is that the successful passing of testing does not indicate a systematic mastery of the entrant of this particular subject, but indicates the formation of a certain database. Thus, it does not develop the ability to use the learned material to solve practical problems, not to mention the ability to synthesize new knowledge. This is not the fault of the applicants, as no one has set them a task or taught them to solve practical problems, let alone synthesize new knowledge. They were given the task to learn to perform test tasks within the EIE, and motivated and able students learned it.

In-depth study of any subject requires students not only a good memory, but also the ability to think systematically. This ability is based on the relevant abilities of a particular individual and is formed and improved in the learning process.

However, the system of education, aimed only at the successful completion of the EIE, does not help to improve the ability to think systematically, and at best leaves it at the same level that the individual inherited.

University entrance control over the level of mastery of mathematics by first-year students showed a low level of training, even in those who had high scores in the external independent evaluation in mathematics. Problems in the text presentation caused special difficulties, which provided for the need to first formulate a mathematical problem, and then solve it. Units solved problems that had many solutions under the conditions, and correctly formulated the answer in problems that did not have solutions for the given parameters [32].

This level of mathematical training of entrants makes it almost impossible to train engineers, which are extremely necessary for the implementation of plans for innovative development of Ukraine.

Thus, society faces the problem of finding a mechanism of self-organization that will direct the most talented students and their parents, relatives to the systematic mastery of certain disciplines, and not just to successful testing within the EIE.

According to the author, it is possible to fulfill the task of training high-level specialists in priority specialties for Ukraine only if the problems of the state procurement system and the rules of admission to the HEI are solved.

Therefore, it is necessary to create such objective conditions that would guide learners and their parents from high school to the maximum use of the child's natural abilities in certain areas of knowledge. It is critical to form in parents and students during their studies at school the desire to make the most of existing skills in the field of exact or humanities in the process of choosing a future specialty when entering the HEI.

Thus, it is necessary to start the mechanism of self-organization in the system «parents, students, schools». To this end, it is necessary to create such an atmosphere in the country that parents send their children to schools that provide systematic knowledge; they turned to tutors

who form children's ability to think systematically in general, and especially in those areas of knowledge that meet the strategic interests of the state.

To create such an atmosphere, it is necessary to transform public opinion. Today, it is strategically important to prepare the most capable students in the field of mathematics and natural sciences to work in certain areas of knowledge, recognized as a strategic priority in Ukraine.

We must also take into account that in our society the so-called «impression economy» prevails, in which the principle of «price – quality» ceases to play a decisive role in the process of choosing a specialty for a child when entering the HEI. Very often, entrants prefer not those specialties that have more government orders and lower tuition fees, and not those that are most in demand in the labor market, but those specialties that are considered prestigious from the public point of view. Examples are given in the previous section of this monograph.

It is necessary not to ignore the economy of impressions, no matter how we treat it, but to use its features to achieve the desired result. It is necessary to make the specialties necessary for Ukraine prestigious so that it would be objectively economically and morally profitable for able students and their parents to choose them.

This task is not easy, but can be solved within 5–7 years, provided the development and implementation of a system of measures at the state level. Such a system of measures should take into account economic, organizational and media components.

The author proposes to divide the state order into two components – strategic and socio-economic. The size of the state order and its financing for specialties that constitute the strategic needs of the state have significant features due to the specifics of training and work in these specialties.

It cannot be allowed, that the HEIs stop training specialists in unpopular specialties from the point of view of the public and business entities, as this will lead to undesirable consequences in the future. Therefore, it is necessary to create objective conditions for the formation of motives for choosing such specialties. The list of such specialties should be very narrow and determined at the level of the CMU.

It is also very important not to lose specialists in the field of basic sciences, without which it is impossible to even imagine significant achievements in either science or innovation.

For example, specialists in theoretical physics, chemistry, biology or mathematics can only be minimally on the list of needs of the population and economic entities, while the needs of the state, which pursues a course of innovative development, must fully cover these factors.

You do not need many such specialists. Quite a few people in each specialty. However, in order to prepare them, it is necessary to select capable applicants. It is impossible to do this administratively and by persuasion alone. Objective conditions should be created that would motivate the most talented young people in high school to obtain higher education in the relevant specialties. In this regard, it is necessary to activate more compelling motives for attracting the best applicants, including [32]:

– guaranteed first job;

– salary supplement in the amount of 100–200 % during the first 3–5 years of work;

– provision of official housing with the possibility of redemption for 10–15 years;
– significantly increased scholarship (by 100–200 %);
– free dormitory for the period of study.

Such motives can indeed form, mainly from the elements of the first cluster, a new supercluster of entrants who will take part in a real competition for specialties that meet the strategic needs of the state, as they will become prestigious and guarantee successful graduates a quality social package.

The strategic state order can be organized in the form of grants, which are provided on a competitive basis to ensure the implementation of the relevant state project. The competition is open to entrants who have scored at least 190 points in the external academic disciplines. Contestants take an exam in specialized subjects and pass a professional interview. The winners sign an agreement outlining the responsibilities of both the grantee and the state. The conditions provided by the state must take into account all the previously mentioned motivational aspects for a strategic public procurement.

The implementation of such an approach will allow launching self-organization mechanisms in the «parents, students, school» system to select the best students and teachers to prepare for admission to specialties related to the strategic needs of Ukraine, and prepare the necessary specialists for state building.

As for the state order for specialties that meet the socio-economic needs of the state, it can be significantly reduced. In addition, it is necessary to significantly improve the mechanism of distribution of the state order between the HEIs. According to preliminary calculations, the fact of distribution in 2019–2020 is inefficient.

The analysis of data on the number of enrolled students in the Unified State Electronic Database on Education (USEDE) shows a significant shortcoming of the system of distribution of public procurement between the HEIs, which actually discredits the country's engineering education:

– 2019 year: 734+723=1,457/8,926=16.3 %;
– 2020 year: 621+778=1,399/8,737=16.0 %.

Eleven such specialties were selected for analysis, which provide for a strong material and technical base for the training of quality professionals. Lack of funding has led to a state of special laboratories for training, which in no way meets modern requirements. A significant amount of funds from the general budget fund is required to significantly upgrade laboratory equipment. However, in the conditions of a phenomenal dispersion of the state order for the training of bachelors in technical specialties through an excessive network of HEIs, a real update of the laboratory base of all HEIs is objectively impossible.

For example, specialty 141 «electric power, electrical engineering and electromechanics» is definitely one of the most popular businesses. In 2020, the state order for bachelor's training in Ukraine was 2,428 people, of which 1,298 people on the basis of complete general secondary education (CGSE) and 1,130 on the basis of a junior specialist. In 2019, respectively: in total – 2,450 people, including 1,115 people on the basis of CGSE and 1,335 people on the basis of a junior specialist (**Table 3.10**).

**Table 3.10** The number of persons enrolled in some specialties (bachelor's level) [33]

| No. | Code | Name of specialty | Year | The total number of HEI holding training | Total enrolled students (budget) | on the basis of: Complete general secondary education | | | | on the basis of: Junior specialist | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | number of HEI | number of students enrolled (budget) | including the number of HEI in which only less than 10 people are enrolled | the number of students (budget) enrolled in groups of less than 10 people | number of HEI | number of students enrolled (budget) | including the number of HEI in which only less than 10 people are enrolled | the number of students (budget) enrolled in groups of less than 10 people |
| 1 | 183 | Environmental protection technologies | 2019 | 25 | 149 | 23 | 101 | 21 | 72 | 15 | 48 | 15 | 48 |
| | | | 2020 | 28 | 172 | 28 | 118 | 26 | 86 | 15 | 54 | 15 | 54 |
| 2 | 133 | Industry engineering | 2019 | 58 | 1,482 | 53 | 582 | 35 | 142 | 54 | 900 | 17 | 81 |
| | | | 2020 | 58 | 1,383 | 53 | 696 | 25 | 89 | 58 | 687 | 24 | 98 |
| 3 | 141 | Electric power, electrical engineering and electromechanics | 2019 | 68 | 2,450 | 59 | 1,115 | 23 | 91 | 66 | 1,335 | 18 | 169 |
| | | | 2020 | 68 | 2,428 | 61 | 1,298 | 24 | 97 | 68 | 1,130 | 22 | 105 |
| 4 | 144 | Heat energy | 2019 | 30 | 279 | 27 | 136 | 25 | 81 | 25 | 143 | 18 | 86 |
| | | | 2020 | 33 | 204 | 30 | 160 | 24 | 67 | 28 | 144 | 24 | 98 |
| 5 | 131 | Applied mechanics | 2019 | 47 | 1,309 | 43 | 673 | 24 | 84 | 44 | 636 | 21 | 110 |
| | | | 2020 | 49 | 1,202 | 45 | 714 | 22 | 76 | 48 | 488 | 28 | 109 |
| 6 | 275 | Transport technologies | 2019 | 40 | 1,080 | 37 | 771 | 14 | 60 | 40 | 309 | 13 | 26 |
| | | | 2020 | 36 | 1,142 | 33 | 703 | 14 | 41 | 35 | 439 | 16 | 67 |
| 7 | 205 | Forestry | 2019 | 27 | 403 | 24 | 203 | 16 | 63 | 27 | 200 | 14 | 44 |
| | | | 2020 | 26 | 350 | 22 | 175 | 12 | 41 | 23 | 175 | 13 | 36 |
| 8 | 193 | Geodesy and land management | 2019 | 44 | 677 | 39 | 505 | 8 | 33 | 44 | 172 | 33 | 86 |
| | | | 2020 | 44 | 740 | 40 | 491 | 11 | 29 | 40 | 249 | 26 | 102 |
| 9 | 274 | Road transport | 2019 | 35 | 576 | 31 | 306 | 11 | 31 | 34 | 270 | 7 | 17 |
| | | | 2020 | 35 | 657 | 31 | 392 | 10 | 27 | 35 | 265 | 16 | 59 |
| 10 | 136 | Metallurgy | 2019 | 9 | 246 | 9 | 78 | 5 | 19 | 9 | 168 | 2 | 15 |
| | | | 2020 | 12 | 216 | 12 | 66 | 9 | 28 | 12 | 150 | 6 | 19 |
| 11 | 142 | Energy engineering | 2019 | 15 | 275 | 14 | 86 | 12 | 58 | 15 | 189 | 7 | 41 |
| | | | 2020 | 15 | 243 | 14 | 122 | 7 | 40 | 15 | 121 | 8 | 31 |
| Total | | | 2019 | | 8,926 | | 4,556 | | 734 | | 4,370 | | 723 |
| | | | 2020 | | 8,737 | | 4,935 | | 621 | | 3,902 | | 778 |

In 2020, 61 HEIs received this order for the training of bachelors on the basis of complete general secondary education (59 HEIs – 2019). Of these, 24 HEIs recruited less than 10 people according to the formula «budget+contract» (in 2019 23 HEIs). 97 students study in such HEIs by state order (in 2019 – 91 students). On the average 4 persons on one HEI each year!

Thus, in 2020, 7.5 % (97/1,298) of students by state order study in small groups, and in 2019 9 % (91/1,115).

State orders on the basis of a junior specialist were received in 2020 by 68 HEIs (in 2019 – 66 HEIs), of which 22 HEIs were scored less than 10 according to the formula «budget+contract» (in 2019 18 HEIs). 105 students study in such HEIs by state order (169 students in 2019), or on average 6.8 people per one HEI in two years! This means that 12 % (274/2,465) of students by state order study in such small groups.

A total of 452 white students in this specialty were admitted to study in the HEIs, which have an average of 4–7 people by state order. The worst thing is that these HEIs do not have such authority in training specialists in this specialty to recruit students on a contractual basis to fill an academic group of up to 25 people.

There is a rhetorical question about the quality of training of engineers in such HEIs. Funding from the general and special fund for such a large number of students will not be enough not only to upgrade the laboratory base and utilities for its maintenance, but also for the salaries of teachers and engineering staff.

In practice, the educational process for the formation of professional competencies is at best reduced to excursions to specialized enterprises and lectures on streams where students of different specialties are reduced.

At first glance, four and a half hundred unprepared students with state diplomas nationwide is not a big deal. Employers will give them an assessment. However, even in these 11 specialties, which are presented in **Table 3.10**, the total number of such lost professionals in two years is 2,856 people (amounts in columns 10 and 13 of **Table 3.10**). This is 17 % of the total number of persons under the state order 17,663 (the amount in column 6 of **Table 3.10**).

In other words, about 17 % of the funds of the general fund of the Budget, which were spent on government orders in 2020 and 2019 only in these specialties were used extremely inefficiently.

In the author's view, it is necessary to increase the efficiency of public procurement management at the level, in this case, of the Ministry of Education and Science of Ukraine. It is enough to analyze the use of the state order for HEIs for two or three years. On the basis of this analysis, to block the receipt of state orders for specific specialties by those HEIs that is not able to provide a full-fledged filling of the academic group according to the formula «budget+contract». If the HEI has an authority in society in the field of training specialists in a particular specialty, then its academic groups will be filled with contract students.

This is especially true of specialties for which it is impossible to train a quality specialist without a modern laboratory base. It is not possible or effective to finance the renewal of such a base for

all HEIs, so their specialization is the first step towards improving the quality of training of specialists with higher education.

This approach will make it possible to ensure in three or four years the specialization of HEIs in specific specialties, which will be the objective foundation for:

– optimization of the network of HEIs of Ukraine;

– financing the renewal of the laboratory base of specialized HEIs.

In general, the synergetic effect in improving the quality of education can only give a comprehensive improvement of the rules of admission to HEIs, the system of state procurement for specialists with higher education and the system of strong material incentives needed by the state specialists. Real progress in this direction can be provided within 5–6 years.

# 4 FINANCING OF HIGHER EDUCATION IN UKRAINE


## ABSTRACT

A quantitative analysis of the system of financing higher education in Ukraine, including the current system of distribution of budget funds between institutions of higher education. The necessity of adaptation of the formula of distribution of means between HEI of Ukraine to a real economic situation is proved.

An analysis of the possibility of raising funds from external stakeholders to finance educational and research work at universities.

The shortcomings of the current system of university financing and ways to eliminate them are substantiated.



## KEYWORDS

General Budget Fund, Special Budget Fund, distribution formula, Tax Code of Ukraine, cost of educational services.


### 4.1 GENERAL QUESTIONS

The current state of social development shows that the main source of competitiveness, long-term economic growth and scientific and technological progress of the country is education and investment in human resources. According to experts, in countries with the most developed economy on average 60 % growth of national income is determined by the growth of knowledge and education of society [34].

The development of the country, its position in the world rankings directly depend on the level of education and higher education, in particular, because «human resources and intellectual assets have a positive impact on national competitiveness» [35].

Financing of higher education is the main tool for influencing the processes of transformation in HEI and the main method of achieving positive results in education, one of the key issues of educational policy [36]. Therefore, finance in higher education is a key resultant of capacity, as they [37]:

– increase the initial capacity for innovative changes that lead to increased productivity, better targeting the needs of target groups of beneficiaries;

– motivate universities to compete for students, faculty, new markets and business contracts;

– expand the access of the population and business to knowledge, skills, best practices, new technologies, innovative practices and products.

«The relative level of higher education institutions funding for 2014–2017 has decreased threefold. That has led to the fact that the state budget provides money for salary, payroll, stipends, and partly utilities.

Funds for the development of higher education institutions and capital expenditures are allocated in the amount of 0.3 % of total funding. Although the funds for the development of higher education institutions have never been allocated in the required amount, some years ago, they were 3.5 %. They were spent on the material and technical re-equipment, repairing of premises, purchase of vehicles, appliances, and laboratory equipment. In 2000–2016, most developed countries in Europe, except for Italy, Ireland, and Portugal, systematically increased their higher education expenditures for capital needs. Leaders of higher education capital expenditures are Canada, Czech Republic, Sweden, Lithuania, and Latvia. Ukraine has reduced capital expenditure in higher education to zero» [38].

In Ukraine, the rate of education expenditures as a share of GDP is quite high compared to other countries analyzed, but it should take into account the fact of the shadow economy in Ukraine, which reduces the size of real indicators, and the fact that the cost per student Ukraine will unequivocally «paste back» [36].

Financing of higher education in Ukraine has been carried out from the Budget for over twenty years, as free economic education institutions have the status of budgetary institutions. Funds are allocated from general and special funds. The monograph [39] analyzes in detail the situation in Ukraine on this issue. However, many specific problems in the field of higher education funding are waiting to be resolved.

By the way, the legitimacy of the allocation of funds received by the HEI from the provision of educational services, research and international grants to the budget category for two decades raises reasonable doubts. Their annual total amount is comparable to the amount of funding for higher education from the general fund. The significant amount of these funds causes the reluctance of the leaders of the Cabinet of Ministers to remove them from the category of budget.

First, such a step, purely formally, will significantly reduce the size of the country's budget, which to some extent characterizes the efficiency of the Government. Thus, the withdrawal from the special fund of the Budget of funds received by the HEI from the provision of educational services, research and international grants is a deliberate deterioration of the formal performance of its activities.

Secondly, the funds received by the HEI from the provision of educational services, research activities and international grants are removed from the restrictions on their use, which are typical of budget funds. Apparently, these restrictions, in the opinion of the leadership of the Cabinet of Ministers, provide both efficiency of use and protection against abuse by the heads of HEIs.

It should be noted that any generalized restrictions, with very few exceptions, are counterproductive. For example, a limit on the purchase of computers of about $ 800 may be effective in purchasing computers for deputies of all levels, management, and their secretaries. This is probably the end of the effectiveness of such a restriction. Because, a specific question arises: how can

a computer class be equipped for the formation of professional competencies in applicants for educational programs «multimedia publications», «journalism», «marketing», etc.? Therefore, the formation of the necessary competencies in such cases requires the use of special software that requires such characteristics of the PC, which in any way do not fit into this limitation.

It is methodologically correct to control not so much the process as the result of activity. Ukraine has a strong system of control, law enforcement and courts, which, if desired, can detect abuse and punish the perpetrators.

Regarding the ratio of funding from the general and special fund in certain HEIs, the results of the study are presented in monographs [39], [18]. In the monograph [18] for the purpose of some systematization the universities which had reporting data on the sites are considered.

Universities were divided into six sufficiently conditional groups: classical, technical, branch, economic, pedagogical and «privileged». For analysis, we considered the data for 2018, which are provided on the websites of various universities.

The group of «privileged» consists of universities that, according to the law, have increased salaries of their employees: Taras Shevchenko National University of Kyiv, National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», The National University of Life and Environmental Sciences of Ukraine (Kyiv), National Aviation University (Kyiv), Yaroslav Mudryi National Law University (Kharkiv).

The group of branches includes: National Transport University (Kyiv), The National Metallurgical Academy of Ukraine (Dnipro), Ivano-Frankivsk National Technical University of Oil and Gas, National University of Food Technologies (Kyiv).

The group of teachers included: National Pedagogical Dragomanov University (Kyiv), H. S. Skovoroda Kharkiv National Pedagogical University, Gryhorii Skovoroda State Pedagogical University in Pereyaslav-Khmelnytskyi, Berdyansk State Pedagogical University.

The group of economic includes: Kyiv National Economic University after named Vadym Hetman, Kyiv National University of Trade and Economics, Simon Kuznets Kharkiv National University of Economics, Odessa National University of Economics, Ternopil National University of Economics.

Polytechnics include: National Technical University «Kharkiv Polytechnic Institute», Dnipro State Technical University, Ternopil Ivan Puluj National Technical University, Lviv Polytechnic National University.

Classical universities: V. N. Karazin Kharkiv National University, Ivan Franko National Lviv University, Oles Honchar Dnipro National University, Kryvyi Rih National University, Vasyl Stefanyk Precarpathian National University, Uzhhorod National University.

The analysis was conducted for each university in terms of the ratio of general and special funds and in terms of the structure of expenditures for each of these funds.

The structure of expenditures on various funds and universities in the context of generalized articles was considered:

1) (Salary) – salary (takes into account salary and accrual on it);

2) (KP) – utilities (all utility payments);

3) (SD) – maintenance and development, includes the following codes of economic classification of budget expenditures:

a) Code 2200 (except 2270–2276) including:

– Code 2210 – items, materials, equipment and inventory (cost up to UAH 7,200 including VAT);

– Code 2240 – current repairs, maintenance of computers, elevators, waste disposal services, etc.

b) Code 3000 – capital expenditures:

– Code 3110 – purchase of equipment and durable goods (worth more than UAH 7,200 including VAT);

– Code 3120 – capital construction;

– Code 3130 – overhaul.

General conclusions on universities of all groups: the ratio of expenditures from the special fund to general expenditures differs dramatically (18–70 %, or an average of 41.9 %) and, accordingly, the percentage of expenditures from the general fund in all expenditures of the university is within 30.3–82.5 %. It should be reminded that according to the report on the implementation of passports of budget programs for 2019, the amount of expenditures from the general fund was 61.26 %, while from the special fund – 38.74 %.

The monograph provides a detailed analysis of expenditures for each group of universities, but the summary data presented in **Table 4.1** are indicative, where for each group of universities the average values of the following indicators are indicated:

– percentage of expenditures from the special fund;

– expenses for one budget student from the general fund;

– expenses for one student-contractor from the special fund;

– percentage of expenditures from the special fund for the maintenance and development of the university;

– amount for maintenance and development paid by each contract student.

**Table 4.1** Average expenditures of university groups for the training of specialists from general and special funds [18]

| Groups of universities | Percentage of special fund | Expenditures per student general fund, thousand UAH | Expenditures per student from special fund, thousand UAH | The percentage of expenditures on MD from special fund | Amount on MD from each contract student (Col.4 × Col.5)/100 |
|---|---|---|---|---|---|
| Classic | 41.9 | 31,5 | 21,5 | 19.3 | 4.15 |
| Polytechnic | 26.5 | 39,7 | 16,9 | 17.38 | 2.94 |
| Economic | 49.5 | 36,4 | 17,2 | 28.9 | 4.97 |
| Pedagogical | 34.7 | 32,5 | 11,9 | 24.76 | 2.94 |
| Sectoral | 39.8 | 22,9 | 18,3 | 10.63 | 1.94 |
| «Privileged» | 30.8 | 58,6 | 36,98 | 21.6 | 7.99 |
| Average value | 37.2 | 36,93 | 20,46 | 20.43 | 4.16 |

These calculations do not claim accounting accuracy, but allow to draw some general conclusions:

– «privileged» HEIs have less than the average percentage of filling the special fund (30.8 % on average – 37.8 %). This can be partly explained by the insufficient motivation of these HEIs to earn money. Only polytechnic HEIs have less (26.5 %);

– «privileged» HEIs have much higher than average expenses per student from the general fund (58.93 thousand UAH for an average of 36.93 thousand UAH);

– «privileged» HEIs have expenditures from the special fund per student higher than the average, due to higher wages;

– «privileged» HEIs allocate a significantly smaller percentage of the special fund for development and maintenance than economic and pedagogical ones (21.6 % compared to 28.9 and 24.76 %).

In general, the presented classification of HEIs by groups gives little to the development of management decisions at the university level. It states the obvious fact that the increased level of salaries of employees of «privileged» universities allows management not to worry too much about attracting funds from external stakeholders.

The classification of universities according to the percentage of the special fund, which is allocated not for food, but for maintenance and development, gives a different picture. The group of universities that spend from 0 to 15.1 % on maintenance and development is 14 units.

Universities that spend 15.2 % or more on maintenance and development also make up a group of 14 units (**Table 4.2**).

Of the half of the selected HEIs, which had reporting data on their websites, UAH 1,602,000 was allocated for the maintenance and development of each student-contractor. While the second half was actively developing and allocated 7,544 thousand UAH for each student-contractor. This difference demonstrates the radically different approaches of the management of each specific HEI to its strategic development.

A specific analysis of the real situation in the use of special funds of universities showed that not everyone uses them effectively. There are several publications in the literature that offer different algorithms for increasing the economic potential of HEI.

**Table 4.2** Indicators of HEIs with different values of expenditures for maintenance and development [18]

| Sign of classification | Number of HEI | Expenses per student from general fund, thousand UAH | Expenditures per student from special fund, thousand UAH | The percentage of expenditures on MD from special fund | Amount on MD from each contract student (Col.3 × Col.4)/100 thousand UAH |
|---|---|---|---|---|---|
| HEI with expenses share on MD less than 15.1 % | 14 | 35,9 | 19,3 | 8.3 | 1,602 |
| HEI with expenses share on MD more than 15.2 % | 14 | 37,4 | 23 | 32.8 | 7,544 |

«It has been concluded that investing in increasing the economic potential of university contributes to the improvement of its individual elements due to the possibility of implementing measures. They are aimed at effective interaction with stakeholders, raising the level of human capital through the implementation of training and development programs for personnel; financing of innovation activity, educational, scientific and social programs; informatization of educational process, scientific, scientific and technical activity and management; alignment with the strategic priorities of the organizational structure, technology and management system of university. Solving the problem of optimal allocation of available investment resources with the use of the proposed EMM will contribute to the growth of the economic potential of university, its financial stability and independence, and the ability to operate autonomously in the future [40]».

In addition, the paper [41] proposes to allocate several funds to strengthen scientific capacity and publishing activity. «Our research has shown the determining factors of the effectiveness of pedagogical activity in higher education in Ukraine are the factors of scientific potential and publication activity. It seems advisable to include in mentioned regulatory acts the thesis about the separation of all financial resources allocated for higher education in Ukraine into three trusted funds: General Financing Facility for Higher Education Institutions; Higher Education Developmental Fund; The social funding in higher education, where all expenses will be accumulated financing to scholarships and other social support guaranteed by the state».

As a preliminary conclusion, it can be stated that the problem of higher education development in Ukraine is not only insufficient funding, its structure and dispersion of public procurement, but also insufficient efficiency of HEI management.

## 4.2 PROBLEMS OF FORMATION AND USE OF THE SPECIAL FUND OF THE BUDGET BY INSTITUTIONS OF HIGHER EDUCATION OF UKRAINE

To ensure the development of higher education it is necessary to use not only public funding, but also funds from other sources – individuals who agree to pay the cost of training to ensure future career growth in prestigious or interesting for them specialties, business entities that seek to obtain highly qualified specialists, local governments, aimed at ensuring effective governance at the local level by attracting qualified management professionals. In fact, a special budget fund is formed from the listed sources. The most successful in the formation of a special fund as shown in the monograph [18] are economic and classical universities. This thesis is partially confirmed in the monograph [39].

In reality, such a situation is formed within the framework of the «economy of impressions» operating in Ukraine today. Unfortunately, as shown in Section 2 of this monograph, our applicants are not interested in attitudes such as «price-quality», «the number of vacancies in the labor market-the number of graduates in the specialty». Romantic expectations from the specialties

of «international relations and regional studies» and «international economic relations» under the influence of the media and social networks prevail over common sense. Although experience shows that employment in these specialties both in Ukraine and abroad is many times more difficult than, for example, in marketing, management, IT – technologies. However, the fact remains that the set of international specialties prevails over demand.

In addition, the attractiveness of some specialties is due to the lack of mandatory certificates of external examination in mathematics. This is also a problem, especially our secondary education. See Section 3 of this monograph.

Thus, the fullness of the special fund of the HEI largely depends on the demand for educational services from applicants and their parents.

In order to help entrants pay for tuition, the Government adopted Resolution of the Cabinet of Ministers of Ukraine No. 916 of June 16, 2003 «Procedure for granting targeted preferential state loans for higher education». Each year a certain amount is allocated for such loans. This Resolution to some extent stimulates the filling of the special fund of the Budget.

However, as is often the case, a great idea is discredited by the implementation mechanism. In this case, a strange scheme of providing and maintaining these loans was chosen. The envisaged mechanism does not ensure the return of targeted loans provided to young citizens for higher education.

Disadvantages of the current mechanism:

– higher education institutions without experience are forced to engage in business activities for the issuance and repayment of loans, which, according to current legislation, have the right to engage in banking institutions that have the appropriate licenses issued by the NBU, and qualified professionals in this field;

– to implement the proposed mechanism, higher education institutions should create special lending departments, which would deal with the issuance of loans, their repayment, track the career of graduates who received loans, change of place of work, etc., which requires additional funding;

– according to the current legislation, it is almost impossible to forcibly collect from the borrower a debt that is not secured by collateral.

In order to eliminate these shortcomings, it is proposed to finalize the Resolution of the Cabinet of Ministers of Ukraine No. 916 of June 16, 2003.

First, the provision of targeted soft loans should be carried out through an authorized state bank with an agreement between it and the borrower.

Second, loans to borrowers must be insured with a state insurance company with interest on the loan amount.

Third, after graduating from higher education and employment, the borrower of the target soft loan must renew the agreement with the authorized bank on the payment of interest on the loan agreement and repayment of the principal amount of debt from salary, as provided by citizens buying consumer goods on credit in the retail network.

The proposed improvements will actually allow to introduce the lending process into the legislative stream and ensure the repayment of loans provided by the state.

The analysis of the market of educational services in terms of the amount of tuition fees showed that a large number of HEIs set prices for tuition on the contract extremely low. Even a cursory glance suggests that it is impossible to train a competent specialist for an annual price equal to the minimum monthly wage. Thus, the educational process can be provided neither by qualified scientific and pedagogical staff, nor by the material and technical base. This approach allows financially barely retain management staff in the practical absence of the educational process.

We must pay tribute to our government, which in 2019 decided to take measures to limit the possibility of setting dumping prices on the contract form of training, which is much lower than the costs provided from the general fund of the State Budget and can not ensure quality education.

At first glance, the system of tuition fees for individuals, business entities seeking to obtain highly qualified specialists in Ukraine was resolved by the adoption of Resolution No. 191 of March 3, 2020 «Some issues of indicative cost» (hereinafter in the Resolution.) And not creates any problems for either payers or HEIs. However, a detailed examination of the issue shows that problems exist and need to be addressed.

In general, such an event is supported by most HEI, but the form of its implementation is questionable. It is really necessary to eliminate the possibility of dumping in the system of higher education, but the adopted Resolution does not eliminate the possibility of setting a dumping price, but only narrows the range of HEI that have the ability to do so.

The calculation of the indicative cost of training is based on the ratio of expenditures from the general fund of the HEI on salaries with accruals, utilities to the estimated contingent of applicants studying under the state order. Since the numerator of the formula does not depend on the specialty, and the denominator is the estimated contingent, which significantly depends on the specialties for which specialists are trained in this HEI, it means that the larger the indexes of specialties the greater the denominator. Indices will have indicative prices for all their specialties lower than HEI with specialties with indices at the level of 1–1.2.

De facto, in 2020, some technical universities had a dumping price, for example for economic and sociological specialties in relation to prices for the same specialties in specialized universities, because their profiling ratio was close to one. This has led to unequal conditions in the enrollment of students in the contract form of education. Paradoxically, it was advantageous for entrants to go to technical universities for economics, sociology and other humanities, which, of course, will not improve the quality of training.

For reference: in the past, in 2020, according to the Kharkiv HEIs, the indicative tuition fee ranged between UAH 14,000 up to UAH 29,000.

Thus, the problem of combating the establishment of dumped prices is not completely solved, although the range of HEIs that have the ability to do so has decreased.

As a proposal to improve the Resolution, it is proposed, for example, to set *the indicative cost of training not less than the weighted average for each specialty in all HEIs of the region for the previous year*. This approach will not only keep the price level much higher than before the adoption of the Resolution, but also ensure its annual growth.

Another source of filling the special fund of the university is the payment of applicants for living in a dormitory. However, for almost ten years, the unprofitable maintenance of hostels has only increased.

There is a vicious circle in this area, because, on the one hand, according to current legislation, they must be funded by applicants for their bed, and on the other – the amount of student hostel fees is limited to 40 % of the academic scholarship.

In 2020, the upper limit of payment for one bed was UAH 520 per month. While the actual costs, for example, Simon Kuznets Kharkiv National University of Economics according to the calculation ranged from 600 to 1,200 UAH. Depending on the month of the year and the characteristics of the hostel.

In order to pay for utilities and pay salaries in 2020, according to the staff list in all seven hostels, the university management had to compensate the difference of UAH 7 million from the part of the special fund formed to pay students for tuition. A similar problem is typical for most domestic HEIs that have hostels for their students.

The solution to this problem is certainly urgent. There are several ways to solve it:

– increase the percentage of the size of the academic scholarship, which determines the maximum amount of payment for a bed. Currently, this limit is 40 %. To compensate for the actual costs of HEIs, it is necessary to increase it to almost 75 %, which is unacceptable given the socio-economic situation in Ukraine;

– increase the size of the scholarship to UAH 2,000, which will lead to a significant increase in expenditures under the Budget Program 01190 «Payment of academic scholarships to students (cadets), graduate students, doctoral students of professional institutions before higher and higher education». This increase will be for all scholarship students, not just those living in hostels;

– increase the size of the scholarship, but reduce the percentage of students eligible for a scholarship. Currently, the norm is that 43 % of students who successfully study at the expense of the general fund of the Budget according to the rating receive a scholarship. A significant reduction in the number of students eligible for a scholarship is also unacceptable given the socio-economic situation in Ukraine;

– divide the hostel fee into two parts. The first will be 40 % of the amount of the academic scholarship, and the second is the actual utility costs, which applicants must pay separately. This approach can also cause active dissatisfaction of students, especially in an unstable socio-economic situation in the country;

– it is proposed to introduce a new budget program, for example, «Payment of compensation for actual utility costs to students living in hostels». The amount of expenditures can be estimated through the requests of the HEI, however, it is clear that they will be much smaller than increasing the size of the academic scholarship to UAH 3,000.

The solution of this problem is archivally important for each institution of higher education of Ukraine as, first, it returns their financial work to the rule of law, secondly, they will be able to use the funds released in this way to purchase the latest equipment from their laboratories.

These measures will allow universities to maintain and increase their own special fund by paying applicants for tuition and living in hostels.

However, in addition to customers in the form of individuals, the educational market is entered by businesses that are also interested in training competent professionals with higher education. Unfortunately, investing in education is not economically encouraged in our country.

Investing in higher education should be profitable for businesses of any form of ownership – this is the real experience of many developed countries. If the state is interested in co-financing higher education with business, then it is necessary to create objective motives for this. Such motives may be tax or organizational leverage.

The filling of the special fund significantly depends on the orders of business entities for educational services and for the implementation of research and development. However, such activity is not economically supported in our state. Consider encouraging businesses through tax breaks.

Tax regulation of business entities is regulated by the Tax Code of Ukraine (TCU). At present, the tools of tax incentives for businesses to spend money on education are not fully used. Therefore, it is considered important to amend the current rules of the TCU in order to increase the effectiveness of existing tax incentives in this area. In particular, the problems are as follows.

There are no incentives in the income tax to spend money on education for businesses whose total income for the previous year exceeds UAH 40 million.

It should be noted that starting from January 1, 2015, income taxpayers with a total income for the previous year of more than UAH 40 million determine the object of income tax by adjusting (increasing or decreasing) the pre-tax financial result (profit or loss), defined in the financial statements of the enterprise in accordance with national regulations (standards) of accounting or international financial reporting standards, on the differences that arise in accordance with the provisions of this Code.

Enterprises whose total income for the previous year is less than UAH 40 million do not make such adjustments and determine the object of income tax only on the basis of accounting data. These taxpayers can reduce the object of taxation by the amount of expenses transferred directly to higher education institutions and individuals who conduct training in these institutions. Therefore, the amount of the transferred funds for education of these taxpayers will reduce the income tax, which is a tax incentive to encourage these taxpayers to spend.

In contrast, «high-income» income taxpayers who adjust the pre-tax financial result do not have the opportunity to reduce the object of income tax by the entire amount of money spent on education.

This is due to the fact that according to the rules of paragraphs 140.5.9 TCU, such payers must increase the financial result of the tax (reporting) period by the amount of funds or value of goods, works performed, services provided, gratuitously transferred (transferred) during the reporting (tax) year to non-profit organizations included in the Register of non-profit institutions and organizations the date of such transfer of funds, transfer of goods, works, services (except for non-profit organization, which is an association of insurers, if the insurer's participation in such

association is a condition of such insurer in accordance with law, and non-profit organizations to which the provisions of subparagraph 140.5.14 of this paragraph), in excess of 4 percent of taxable income of the previous reporting year.

Most higher education institutions are non-profit organizations. Therefore, if the amount of funds that were transferred free of charge by the business entity of the higher education institution exceeds the business entity's limit of 4 % of taxable income of the previous reporting year, the taxpayer will not be able to reduce the object of income tax by this amount.

It should be noted that the TCU has rules with an increased cost limit, the amount of which can be reduced by the object of income tax. Thus, according to the rules of paragraphs 140.5.14 TCU financial result of the tax (reporting) period is increased by the amount of funds or value of goods, works performed, services provided free of charge (transferred) during the reporting (tax) year to the *subjects of physical culture and sports*, namely children and youth sports schools, Olympic training centers, schools of higher sportsmanship, centers of physical culture and sports for persons with disabilities, sports federations of Olympic sports, which are non-profit organizations included in the Register of non-profit institutions and organizations, on the date of such transfer, transfer of goods, works, services in the amount exceeding 8 percent of the taxable profit of the previous reporting year.

This raises the question: why do the funds transferred to the subjects of physical culture and sports fall under the increased limit? Investing funds in higher education is no less important in the development of our country, because it stimulates the training of professionals who will later work in Ukraine.

It should also be noted that it is the «high-income» businesses that have the opportunity to invest money in education, and it is unclear why these taxpayers are at a disadvantage compared to «low-income» income taxpayers. Unlike the latter, «high-income» businesses have the opportunity to reduce the object of income tax not by the full amount of the transferred funds for education, but only by a certain percentage of the amount of taxable income of the previous reporting year.

In view of this, it is considered appropriate to amend the provisions of paragraph 140.5.14 TCU, and exclude from the adjustment under this rule the operation of transfer of funds or value of goods, work performed, services rendered, gratuitously transferred during the reporting (tax) year to higher education institutions (**Table 4.3**).

One of the current norms related to the stimulation of scientific research is the norm of paragraphs 197.1.22 of the Tax Code of Ukraine, which provides for exemption from value added tax transactions for the supply of services for basic research, research and development, if such services and/or works are provided by a person who directly receives payment for their value from account of the body that provides treasury services to budget funds.

Therefore, transactions for the supply of those services that are paid for by business entities are not exempt from VAT. This puts in unequal conditions for VAT taxation of operations on the supply of research institutions with the results of scientific research performed at the expense of the state budget and for funds received from business entities (**Table 4.4**).

**Table 4.3** Suggestions for solving the problem of paragraph 140.5.9 TCU

| Article of the TCU | The current version | Proposals |
|---|---|---|
| 140.5 | The financial result of the tax (reporting) period increases: | The financial result of the tax (reporting) period increases: |
| | … | … |
| 140.5.9 | for the amount of funds or value of goods, works performed, services provided, gratuitously transferred (transferred) during the reporting (tax) year to non-profit organizations entered in the Register of non-profit institutions and organizations on the date of such transfer, transfer of goods, works, services (except non-profit organization, which is an association of insurers, if the participation of the insurer in such an association is a condition of such insurer in accordance with the law, and non-profit organizations to which the provisions of subparagraph 140.5.13 of this paragraph apply), in excess of 4 percent of taxable profit of the previous reporting year | for the amount of funds or value of goods, works performed, services provided, gratuitously transferred (transferred) during the reporting (tax) year to non-profit organizations entered in the Register of non-profit institutions and organizations on the date of such transfer, transfer of goods, works, services (except non-profit organization, which is a higher education institution, a non-profit organization that is an association of insurers, if the insurer's participation in such an association is a condition of such insurer in accordance with the law, and non-profit organizations to which the provisions of subparagraph 140.5.14 of this paragraph apply), in excess of 4 percent of taxable income of the previous reporting year |

**Table 4.4** Suggestions for solving the problem of paragraph 197.1.22 TCU

| Article of the TCU | The current version | Proposals |
|---|---|---|
| 197.1 | Exempt from taxing transactions with: | Exempt from taxing transactions with: |
| | … | … |
| 197.1.22 | provision of basic research, research and development services, if such services and/or works are provided by a person who directly receives payment for their value from the account of the body providing treasury services to the budget | provision of basic research, research and development services, if such services and/or works are provided by a person who directly receives payment for their value from the account of the body providing treasury services to the budget and supply of such services by scientific institutions and scientific organizations, higher education institutions, entered in the State Register of scientific institutions, which are supported by the state |

Stimulating the encouragement of business entities to introduce a dual system of education. Norms of Part 6 of Art. 49 of the Law of Ukraine «On Higher Education» dated 01.07.2014 No. 1556–VII provides a dual form of higher education – a method of obtaining education by full-time students, which provides on-the-job training at enterprises, institutions and organizations to acquire certain qualifications from 25 to 60 % of the total educational program on a contractual basis. On-the-job training involves the performance of official duties in accordance with the employment contract.

Dual education is carried out on the basis of an agreement between a higher education institution and an employer (enterprise, institution, organization, etc.), which provides for:

– the procedure for employment of the applicant for higher education and payment for work;

– the amount and expected learning outcomes of the higher education applicant in the workplace;

– obligations of the institution of higher education and the employer in terms of the implementation of the applicant's higher education individual curriculum in the workplace;

– the procedure for evaluating learning outcomes obtained in the workplace.

In view of this, it is considered appropriate to provide tax benefits for those employers who introduce a dual form of training, in particular, VAT benefits (**Table 4.5**).

● **Table 4.5** Suggestions for solving the problem of paragraph 197.1.2 TCU

| Article of the TCU | The current version | Proposals |
|---|---|---|
| 197.1 | Exempt from taxing transactions with: | Exempt from taxing transactions with: |
| | … | … |
| 197.1.2 | provision of services for higher, secondary, vocational and preschool education by educational institutions, including postgraduate and doctoral studies, educational institutions licensed to provide such services, as well as services for the upbringing and education of children in cultural centers, children's music, art, sports schools and clubs, schools of arts and services for accommodation of pupils or students in dormitories | provision of services for higher, secondary, vocational and preschool education by educational institutions, including postgraduate and doctoral studies, educational institutions licensed to provide such services, as well as services for the upbringing and education of children in cultural centers, children's music, art, sports schools and clubs, schools of arts and services for accommodation of pupils or students in dormitories, as well as the supply of on-the-job training services for specialists of enterprises, institutions, organizations in the dual form of higher education on the basis of an agreement between the higher education institution and the employer (enterprise, institution, organization, etc.) |

There is no definition of the term «scholarship» and the procedure for assigning and paying scholarships to individuals who are studying in higher education.

According to paragraphs 165.1.26 TCU to the total monthly (annual) taxable income of the taxpayer does not include «the amount of the scholarship (including the amount of its indexation, accrued in accordance with the law), which is paid to a student, cadet of military schools, resident, graduate student or associate professor, but not higher than the amount specified in the first paragraph of subparagraph 169.4.1 of paragraph 169.4 of Article 169 of this Code. The amount of the excess, if any, is subject to taxation at the time of its accrual (payment) at the rate specified in paragraph 167.1 of Article 167 of this Code».

Therefore, scholarships paid, including to a student, by any persons (including business entities) in the amount equal to the monthly subsistence level valid for an able-bodied person on January 1 of the reporting tax year are not subject to personal income tax multiplied by 1.4 and rounded to the next 10 hryvnias (in 2021 – 3,180 hryvnias). The military fee is not paid from this amount (item 1.2 item 161 of subsection 10 of section XX of the TCU). If the amount of the scholarship exceeds UAH 3,180, the amount of the excess is subject to personal income tax and military duty.

However, the current legislation does not define the term «scholarship», which leads to difficulties in applying for this benefit. Therefore, the TCU should provide a definition of the term «scholarship».

According to the norms of Part 2 of Art. 62 of the Law of Ukraine «On Higher Education» from 01.07.2014 No. 1556–VII persons who study in higher education institutions on a full-time basis at the expense of state or local budgets, have the right to receive academic and social scholarships in the manner prescribed by law. Thus, Part 3 Art. 62 of this Law states that persons studying in institutions of higher education on a full-time basis may receive other scholarships awarded by individuals (legal entities).

Thus, the current legislation stipulates that scholarships may be awarded to individuals (legal entities). They are usually called nominal. However, the procedure for payment of such scholarships is not specified in any normative document.

The current Procedure for awarding and paying scholarships, approved by the Resolution of the Cabinet of Ministers of 12.07.2004 No. 882 (hereinafter – the Procedure No. 882), applies to persons studying in educational institutions or research institutions by state (regional) order at the expense of the general fund of the state (relevant local) budget. Clause 2 of this document only states that scholarships may be paid to pupils, students, cadets of non-military higher education institutions, trainees, clinical residents, trainee assistants and doctoral students who study in accordance with agreements concluded between educational institutions and individuals or legal entities at the expense of such persons, if provided by the terms of the agreement.

From this it can be concluded that the payment of scholarships to these persons should be provided for in the agreement concluded between educational institutions and individuals or legal entities. There is no standard form of such an agreement. At the moment, there is only a Model Agreement of an economic entity with an educational institution, enterprise, institution, organization that provides training (form No. 1), approved by the order of the Ministry of Labor and Social Policy of Ukraine dated 10.08.2010 No. 232. But this document regulates the procedure for concluding by business entities agreements on training, retraining and advanced training of employees of the business entity who are studying at the educational institution. Therefore, the issue of scholarships is not discussed in it.

In view of this, it is considered appropriate to approve the Procedure for awarding and paying scholarships by business entities and the Model Agreement of the business entity with the educational institution, enterprise, institution, organization that provides training at the expense of scholarships paid by business entities (**Table 4.6**).

The filling of the special fund of the HEI is also hampered by the fact that the current legislation does not encourage the receipt of financial assistance from international organizations. This leads to the unregulated supply of goods and services in the customs territory of Ukraine and the import of goods into the customs territory of Ukraine in the framework of projects funded by NATO.

**Table 4.6** Suggestions for solving the problem of paragraph 165.1.26 TCU

| Article of the TCU | The current version | Proposals |
|---|---|---|
| 14.1.230[1] | … | Scholarship for the purposes of Section IV of this Code is a permanent financial aid provided on a regular basis to pupils, students of professional higher education institutions and higher education institutions, as well as postgraduate and doctoral students, subject to successful study |
| 165.1 | Such income is not included in the total monthly (annual) taxable income of the taxpayer: | Such income is not included in the total monthly (annual) taxable income of the taxpayer: |
| | … | … |
| 165.1.26 | the amount of the scholarship (including the amount of its indexation, accrued in accordance with the law), which is paid to a pupil, student, cadet of military educational institutions, resident, graduate student or adjunct, but not higher than the amount specified in the first paragraph of subparagraph 169.4.1 of paragraph 169.4 of Article 169 of this Code. The amount of the excess, if any, is subject to taxation at the time of its accrual (payment) at the rate specified in paragraph 167.1 of Article 167 of this Code | the amount of the scholarship (including the amount of its indexation, accrued in accordance with the law), which is paid to a pupil, student, cadet of military educational institutions, resident, graduate student or adjunct, but not higher than the amount specified in the first paragraph of subparagraph 169.4.1 of paragraph 169.4 of Article 169 of this Code. The amount of the excess, if any, is subject to taxation at the time of its accrual (payment) at the rate specified in paragraph 167.1 of Article 167 of this Code.<br>The Cabinet of Ministers of Ukraine shall approve the procedure for awarding and paying scholarships for persons studying in educational institutions or research institutions under the state (regional) order at the expense of the general fund of the state (relevant local) budget. The procedure for awarding and paying scholarships for persons studying in educational institutions or research institutions at the expense of economic entities is approved by the central executive body, which ensures the formation and implementation of state policy in the fields of education and science, science, science and technology, innovation in these areas, technology transfer |

In accordance with the Agreement between the Government of Ukraine and the North Atlantic Treaty Organization on the Status of the NATO Delegation to Ukraine of 22 September 2015, ratified by the Law of Ukraine No. 989–VIII of 4 February 2016 (hereinafter referred to as the NATO Agreement), NATO funds projects including scientific institutions. So, according to paragraph «e» st. 1 of the Agreement, «NATO-funded project» means any project or activity,

including, but not limited to, scientific, civil society, technical assistance, or NATO-funded research projects, or under the Program «Science for Peace and Security», a trust fund or otherwise; and according to the norms of paragraph «f» st 1 of the Agreement, «recipient» means any legal or natural person located or resident in Ukraine who receives funds and/or equipment under a NATO-funded project.

The procedure for registration of international scientific and technical programs and projects implemented in the framework of international scientific and technical cooperation by Ukrainian scientists, as well as grants provided in the framework of such cooperation, approved by the order of the Ministry of Education and Science of Ukraine dated 20.11.2017 No. 1507.

At the moment, according to the rules of paragraph 197.11 of the TCU are exempt from VAT, including transactions with:

– supply of goods and services in the customs territory of Ukraine and importation into the customs territory of Ukraine of goods as international technical assistance provided in accordance with international treaties of Ukraine, consent to the binding nature of which is provided in the manner prescribed by law;

– supply of goods and services in the customs territory of Ukraine and importation into the customs territory of Ukraine of goods financed by international technical assistance provided in accordance with international treaties of Ukraine, consent to be bound in the manner prescribed by law.

Paragraph 197.11 of the TCU does not specify which document regulates the procedure for providing international technical assistance. In addition, this norm does not refer to the fact that the procedure for attracting, using and monitoring international technical assistance for the purposes of applying this norm is established by the Cabinet of Ministers of Ukraine.

Meanwhile, the tax authorities refer to the document regulating the procedure for providing international technical assistance in accordance with paragraph 197.11 of the TCU, only the Procedure for attracting, using and monitoring international technical assistance, approved by the Cabinet of Ministers of 15.02.2002 No. 153. This approach is implemented in the Handbook N 103/2 other tax benefits as of 09.04.2021, where in the description of the benefit under code 14060528 «NATO-funded projects, including their assets, income and other property (owned by the recipient or another person on behalf of the recipient) are exempt from all direct and indirect taxes, however, neither NATO nor the recipient will claim exemption from taxes and payments related to the payment of utilities sources inside and outside Ukraine for a NATO-funded project. Such contracts, goods, services and construction are not subject to duties, taxes, value added and other payments in Ukraine. Goods, services and construction acquired in accordance with this provision shall not be alienated by sale or gift in Ukraine, except for the conditions approved by the Government of Ukraine only reference to the Law of Ukraine «On Ratification of the Agreement between the Government of Ukraine and the North Atlantic Treaty Organization NATO Representation in Ukraine» (Articles 25, 26 of the Agreement) and paragraph 3.2, Article 3 of Section I of the TCU.

In this case, the benefit under the code 14060524 «Exempt from taxation of transactions for the supply of goods and services in the customs territory of Ukraine, financed by international technical assistance provided in accordance with international treaties of Ukraine, consent to be binding in the manner prescribed by law» contains a reference to paragraph 197.11 of the TCU.

However, Procedure No. 153 does not apply to projects (programs) funded by the North Atlantic Treaty Organization (NATO) under the Agreement between the Government of Ukraine and the North Atlantic Treaty Organization on the status of NATO Representation in Ukraine.

Therefore, transactions for the supply of goods, works and services under an international technical assistance project registered in accordance with Procedure No. 153 are exempt from VAT under paragraph 197.11 of the TCU, and NATO-funded projects are exempt under paragraph 3.2 of the TCU and the Agreement with NATO. According to the norm of item 3.2 of the TCU, if an international agreement, the binding nature of which has been approved by the Verkhovna Rada of Ukraine, establishes rules other than those provided for by this Code, the rules of the international agreement shall apply.

At the same time, the situation with the accrual of «compensatory» VAT liabilities for goods (services) used in the supply of goods (services) for projects financed by NATO under the NATO Agreement is currently unresolved.

Thus, according to paragraph 198.5 of the TCU, the taxpayer is obliged to accrue tax liabilities based on the tax base determined in accordance with paragraph 189.1 of the TCU, and make no later than the last day of the reporting (tax) period and register in the Unified Register of tax invoices. the terms established by this Code for such registration, consolidated tax invoice for goods/services, non-current assets purchased/manufactured with value added tax (for goods/services, non-current assets purchased or manufactured before July 1, 2015 – if under at the time of such acquisition or production the amount of tax was included in the tax credit), if such goods/services, non-current assets are intended for their use or begin to be used:

a) no adjustment required;

b) in transactions exempt from taxation in accordance with Article 197, Subsection 2 of Section XX of this Code, international treaties agreements, (except for transactions provided for in subparagraph 197.1.28 of paragraph 197.1 of Article 197 of this Code and transactions provided for in paragraph 197.11 of Article 197 of this Code).

In view of the formally stated transactions for the use of goods/services, non-current assets acquired/made of VAT, transactions in transactions that are exempt from VAT under paragraph 3.2 of the TCU (in particular, for NATO-funded projects) are not exempt from accrual «compensatory» tax liabilities in accordance with paragraph 198.5 «b» TCU. This is inconsistent with the systematic interpretation of the law and places unequal taxation of operations funded by NATO-funded international technical assistance projects (**Table 4.7**).

**Table 4.7** Suggestions for solving the problem of paragraph 198.5 TCU

| Article of the TCU | The current version | Proposals |
|---|---|---|
| 198.5 | The taxpayer is obliged to accrue tax liabilities based on the tax base determined in accordance with paragraph 189.1 of Article 189 of this Code, and draw up no later than the last day of the reporting (tax) period and register in the Unified Register of tax invoices within the time limits set by this Code for such registration, consolidated tax invoice for goods/services, non-current assets acquired/manufactured with value added tax (for goods/services, non-current assets acquired or manufactured before July 1, 2015 – if during such acquisition or production the amount tax have been included in the tax credit), if such goods/services, non-current assets are intended for their use or begin to be used:<br><...><br>b) in transactions exempt from taxation in accordance with Article 197, Subsection 2 of Section XX of this Code, international treaties (agreements) (except in cases of transactions provided for in subparagraph 197.1.28 of paragraph 197.1 of Article 197 of this Code and transactions provided for in paragraph 197.11 of Article 197 of this Code) | The taxpayer is obliged to accrue tax liabilities based on the tax base determined in accordance with paragraph 189.1 of Article 189 of this Code, and draw up no later than the last day of the reporting (tax) period and register in the Unified Register of tax invoices within the time limits set by this Code for such registration, consolidated tax invoice for goods/services, non-current assets acquired/manufactured with value added tax (for goods/services, non-current assets acquired or manufactured before July 1, 2015 – if during such acquisition or production the amount tax have been included in the tax credit), if such goods/services, non-current assets are intended for their use or begin to be used:<br><...><br>b) in transactions exempt from taxation in accordance with Article 197, Subsection 2 of Section XX of this Code, international treaties (agreements) (except for transactions provided for in paragraph 3.2 of Article 3 of this Code, transactions provided for in subparagraph 197.1.28 of paragraph 197.1 of Article 197 of this Code and the operations provided for in paragraph 197.11 of Article 197 of this Code) |

We believe that the implementation of the proposals of this section will significantly increase the activity of business entities in ordering educational and research and design services in higher education institutions of Ukraine. The intensification of this process will allow universities to significantly increase the size of their special funds.

### 4.3 FINANCING OF HEI FROM THE GENERAL FUND OF THE BUDGET OF UKRAINE

The approach to financing HEIs from the general fund of the Budget, introduced in 2020, is based on a mathematical model, the main parameters of which are given in the Cabinet of Ministers of December 24, 2019 No. 1146 «On the distribution of state budget expenditures between higher education scientific and international activities» (hereinafter – the Resolution of the Cabinet of Ministers of Ukraine 46 1146) [42].

This approach is based on the idea of basic funding through the distribution of funds allocated in the budget for the relevant programs between the HEIs. Therefore, they do calculate *not the cost of training specialists, but redistribute funds, which have already been allocated. Thus, the issue of adequacy of funds to ensure quality training of specialists with higher education is not even considered*.

The Resolution of the Cabinet of Ministers of Ukraine No. 1146 takes into account the amount of funding of the previous year as a fund for stable activities of the HEI and allocates some part resources to stimulate those HEIs that train specialists needed by Ukraine.

Consider the action of the Resolution of the Cabinet of Ministers No. 1146 on the example of its application in 2020. The amount of funding for stable activities of HEIs – in 2020 is 80 % of funding for 2019. According to the Resolution of the Cabinet of Ministers No. 1146 each year discretion.

If it is left at the level of 80 %, then those HEIs that received less than 100 % of the amount of funding provided in the current year, depending on the results of activities, will receive 80 % of the reduced amount next year. Thus, each subsequent year, these HEIs will have a regressive (reduced compared to the previous year) amount of financing for stable activities. Therefore, it is necessary to analyze the list of these HEIs and decide whether to eliminate them. Because many of them are successful and need Ukraine free socially, and their trouble is that they can not show a decent result within the indices of specialties, adopted, by the way, without economic justification, and performance indicators selected for a narrow range of HEIs also without economic justification. Although the formula provides for the possibility of limiting the reduction or increase of the total funding of stable activities and the funding provided, depending on the performance of the HEI with the help of the appropriate coefficient set by the Ministry of Education and Science.

However, even with a correct economic justification of indices and indicators, according to their essence, the proposed formula does not have the leverage of the state. *Therefore, it is proposed to introduce an index of state support for the specialty, the size of which can be justified by the current or strategic needs of the state!*

Consider the current model with comments and suggestions for its improvement.

The amount for all HEIs in 2020 had the amount of expenditures to finance their stable activities (FSA) UAH 11,874,372,060. Some basic and calculated data are given in [18].

This is how the first component of HEI financing is formed.

The second part of the amount of funding provided, depending on the results of activities (FRA), is formed as the difference between the amount of expenditures to finance the educational activities of HEI FD, the amount of expenditures to finance their stable activities (FSA) and the reserve *R*.

It is critical for the Ministry of Education and Science to ensure compliance with the amount of expenditures for financing the educational activities of the HEI FD, the volume of the state order must take into account the size of the estimated contingent of applicants, not the actual contingent (the difference between these values will be understood later). This is especially true in conditions when the growth of wages and utility tariffs is unpredictable.

The share of expenditures on financing educational activities, which remained after the allocation of expenditures on financing their stable activities (FSA), is distributed by the MES between the volume of expenditures for the performance of the *i*-th institution of higher education (FRA) and the reserve of financing (*R*).

According to the current version of the Resolution of the Cabinet of Ministers of Ukraine No. 1146, the consolidated amount of the reserve (R) for a certain year, its distribution among higher education institutions, use and adjustment are determined by the MES, in accordance with guidelines that are not publicly available.

According to the author, the size of the funding reserve (*R*) should be approximately at the level of 10–15 % of the share of expenditures for financing educational activities, which remained after the allocation of expenditures for financing their stable activities (*FSA*). This reserve gives the Ministry of Education and Science the opportunity to ensure effective operational management of the free economic system during the school year in conditions of socio-economic instability. This reserve, for example, can be used to finance the costs of fire safety for the installation of fire safety systems, other capital expenditures to ensure the viability of fire safety and their dormitories! Moreover, the amount of funding from the general fund under the budget program 01160 «Training of higher education institutions and ensuring the operation of their bases of practice», separately almost never includes development expenditures.

The amount of expenditures for the performance of all institutions of higher education for 2020 (FRA) is set at UAH 3,672,241,120 [18].

Its distribution between the HEIs is calculated by the Ministry of Education and Science taking into account the indicators of the *i*-th HEI, it is defined as the share of expenditures on the indicators of higher education institutions (*FRA*) taking into account the share of the institution ($A_i$) [18] in the sum of performance indicators of all higher education institutions belonging to the sphere of management of the Ministry of Education and Science (amount according to column 20):

$$FRA_i = \frac{A_i}{\sum_{j=1}^{n} A_j} FRA. \tag{4.1}$$

The performance of a particular institution of higher education ($A_i$) is calculated on the basis of the following parameters:

$$A_i = CCo_i \cdot S_i \cdot RS_i \cdot Sc_i \cdot IR_i \cdot LEG_i, \tag{4.2}$$

where $CCo_i$ – the estimated contingent of applicants for higher education who study on the terms of the state order; $S_i$ – indicator of the scale of activity; $RS_i$ – indicator of regional support; $Sc_i$ – indicator of scientific activity; $IR_i$ – indicator of international recognition; $LEG_i$ – employment rate of graduates.

The size of the estimated contingent of applicants for higher education studying on the terms of the state order ($CCo_i$) in the *i*-th institution of higher education on the terms of the state order is not in the official reporting. It is calculated according to the formula (in this formula the index of state support $StS(s)$ is already introduced, which is not in the Resolution of the Cabinet of Ministers of Ukraine No. 1146):

$$CCo_i = \sum_s \sum_f \sum_l \left( AN_{sfli} \cdot I_l \cdot I_f \cdot I_s \cdot StS_s \right), \quad (4.3)$$

where $AN_{sfli}$ – the actual number of higher education students enrolled on the terms of the state order in the *i*-th institution of higher education, by the appropriate level of higher education ($l$), the form of higher education ($f$), specialty (specialization, subject specialty for which the state order is placed) ($s$) as of October 1 previous calendar year; $I_l$ – index of the level of higher education; $I_f$ – index of the form of education; $I_s$ – specialty index; $StS_s$ – index of state support for the specialty.

This index can vary from 1.0 to 2.0 and be determined according to the current or this index can vary from 1.0 to 2.0 and be determined according to the current or strategic needs of the state. In fact, together with the volume of state procurement, the state has the opportunity to give effect to its priorities in the training of specialists with higher education. It is a matter of principle that state support is not provided by HEIs, but purely by specialties, as there may be many other specialties in this HEI that do not require state support. The size of this index should be determined by a separate method.

As shown by formula (4.3), the estimated contingent, in contrast to the actual contingent of applicants studying at the expense of the general fund budget, through the relevant indices *takes into account the relative complexity and cost of training, depending on the characteristics of each specialty, higher education and its form*. Thus, the more expensive and time-consuming is the training of the applicant in a particular specialty, the larger will be the estimated contingent.

We will introduce *an additional indicator*, which is not used in the Resolution of the Cabinet of Ministers of Ukraine No. 1146, but it allows to better illustrate the essence of the indicator of activity of a certain institution of higher education ($A_i$). This indicator does not change the model, it is defined as an algebraic transformation of formulas from the Resolution of the Cabinet of Ministers No. 1146.

It is calculated as the ratio of the estimated contingent of applicants for higher education who study on the terms of the state order, to the actual number of applicants for higher education on the terms of the state order in a particular institution of higher education $(i)$. Let's call it conditionally an *indicator of profiling of the i-th HEI*, although it characterizes not only the set of specialties of HEI, but also the structure of the contingent by levels of education and forms of education:

$$IP_i = \frac{CCo_i}{AN_{sfli}}. \quad (4.4)$$

The substantive analysis shows that this indicator assesses the complexity (complexity) and relative cost of training applicants in the *i*-th HEI, given their specialty, level and form of higher education. The larger the value of the coefficient, the more funds will be allocated to it [18].

In addition to the estimated contingent of applicants for higher education who study on the terms of the state order, when determining the size of the performance of a particular institution of higher education ($A_i$) as parameters used indicators of level: scale $S_i$, research $Sc_i$, international recognition $IR_i$, regional support, employment of graduates $LEG_i$:

$$A_i = EC_i \cdot S_i \cdot RS_i \cdot Sc_i \cdot IR_i \cdot LEG_i, \tag{4.5}$$

where $EC_i$ – the estimated contingent of applicants for higher education who study on the terms of the state order; $S_i$ – an indicator of the scale of activity; $RS_i$ – indicator of regional support; $Sc_i$ – indicator of scientific activity; $IR_i$ – indicator of international recognition; $LEG_i$ – employment rate of graduates.

Taking into account the profiling indicator, the formula for calculating the size of the indicator of activity of a certain institution of higher education ($A_i$) has the following form:

$$A_i = AN_{sfli} \cdot IP_i \cdot S_i \cdot RS_i \cdot Sc_i \cdot IR_i \cdot LEG_i. \tag{4.6}$$

Thus, in kind, the performance of a particular institution of higher education, in fact, in the current model, is adjusted for various indicators of the actual number of applicants for higher education $AN_{sfli}$ who study under the state order in the *i*-th HEI and have units – the number of persons. Therefore, in fact, to move to valuation, it is necessary to to calculate the amount [18] for all HEIs and find the share of each HEI in the total [18], so that accordingly to this share to determine the share in the cost calculation [18].

The profiling indicator is the most important compared to others [18], so it determines the weight of the performance of a particular HEI. This is a strong argument for meticulous substantive and economic justification of the size of both indices of specialties and indices of education levels and forms of education.

*Thus, the profiling indicator has the greatest influence in the current model.* Its variability is 1.32 units (2.16–0.84). In fact, this is correct, but in the open access it was not possible to find a justification for the size of indices of levels and forms of higher education, indices of specialties. Their calculation requires large-scale work (it is necessary to calculate the relative complexity and/or cost of training one specialist in different specialties, levels and forms of higher education). Without such justification, the proposed model is subjective and needs to be adjusted. (Next, a method of economically sound determination of all indices will be proposed).

However, the positive is at least the fact that in one way or another take into account the different size of labor intensity in the training of specialists in different specialties. In the system that functioned until 2020, the difference in funding the training of specialists in various specialties was

determined almost exclusively through the salaries of scientific and pedagogical staff, according to the Cabinet of Ministers of Ukraine dated August 17, 2002 No. 1134 «On approval of standards for students (cadets) graduate students (adjuncts), doctoral students, candidates for the degree of candidate of sciences, students, interns, clinical residents for one full-time position of research and teaching staff in higher educational institutions of III and IV level of accreditation and higher educational institutions of postgraduate education of state ownership» [43].

Doubts of the academic community about the correctness of both the list and the quantitative assessment of indicators are substantiated: $S_i$ – scale of activity; $RS_i$ – indicator of regional support; $SC_i$ – indicator of scientific activity; $IR_i$ – indicator of international recognition; $LEG_i$ – employment rate of graduates. They objectively do not sufficiently characterize the quality of either scientific or educational activities of the HEI. The developers did not pay attention to the extremely important educational component of the free economic activity, which largely shapes the emotional intelligence of the student, his/her cultural level. The system of indicators and proposals for its improvement will be considered in more detail later.

### 4.3.1 JUSTIFICATION OF THE SIZE OF INDICES IN THE FORMULA OF DISTRIBUTION OF BUDGETARY FUNDS

First, we will consistently consider the validity of the size of the indices, which actually form the most important component of the indicator of activity of the HEI and is called the «estimated contingent».

$I_S$ – specialty index. This index should take into account the relative complexity and cost of training one specialist for one year. It ranges from 1 for the specialty, the training of which is the least time-consuming and least expensive, to 3 for the specialty, the training of which is the most time-consuming and costly. Thus, the larger the index of the specialty, the larger the estimated contingent of applicants and the higher the performance of the HEI, which means that the more funds will be allocated from the general fund for the training of one specialist next year.

Of course, from the economic point of view, the specific values of this index should be calculated as the ratio of the cost of training a specialist in one specialty to the corresponding cost in another, but in the process of preparing the Resolution of the Cabinet of Ministers No. 1146 such calculations were not made. In any case, they are not publicly available.

Their absence led to completely unfounded decisions. For example, the relative complexity and cost of primary school teacher training is estimated at 1.2, while journalist training is 1. Although it is clear that in addition to the material and labor costs required to train a primary school teacher, at least additional training is required to train a journalist, photo studio and TV studio with appropriate photo, video and computer equipment, the maintenance of which requires both material and labor costs. Without them, it is impossible to form the necessary professional competencies in applicants. Despite this, less money will be allocated from the general fund of the budget next year for the training of one journalist than for the training of a primary school teacher.

By the way, the same situation with the specialties «marketing», «economics», «hotel and restaurant business» and «management», for which the index is one, although for the formation of the necessary professional competencies of applicants for these specialties are absolutely necessary laboratories of modern technologies, industries and costly special software for computers with relevant characteristics. However, within the framework of the state order, less funds will be allocated from the general fund for specialists in these specialties than for the training of primary school teachers.

Thus, this index does not take into account the ratio of relative labor and cost costs in the process of training one specialist during the year for the state order for all specialties. It is possible that the developers of this resolution when setting the size of the index tried to combine economic and political essence in one index. This approach is not acceptable, as it is not positively perceived by the university community, because it is not clear where the economic justification ends and the political one begins.

Therefore, it is proposed to introduce an index of state support for the specialty $StS_s$, the size of which is determined by the priorities of the Government of Ukraine for next year and may vary from 1 to 2. Due to its size and the volume of the state order for this specialty, the state implements its policy on training with higher education.

As for the index $I_S$, itself, its size should be economically justified and determine the *relative complexity and cost* of training one specialist for one year in each specialty. Hereinafter, the term «specialty» means the position in the annex to the Resolution of the Cabinet of Ministers No. 1146, which gives the meaning $I_S$.

The classical approach to solving this problem involves calculating the cost of training one specialist in a particular specialty, followed by determining its relationship with the cost of training a specialist in another specialty in the HEI of Ukraine and bringing these ratios to a predetermined interval with a certain scanning step.

This problem in general does not have a single solution due to its multidimensionality in various aspects:

– regional;

– size of the HEI;

– a large number of related specialties in the HEI;

– different sizes of the current infrastructure in each HEI.

Therefore, to solve the problem, it is necessary to introduce some simplifications that do not significantly affect the size $I_S$.

Administrative costs for the provision of educational services and other costs that do not depend on the specialty for which specialists are trained, which is accounted for by one applicant, are accepted as the same for all HEI. Therefore, when determining the ratio of the annual cost of training for different specialties, these costs contained in the numerator and denominator are reduced as the same, and therefore their calculation is not required.

The cost and operation of laboratory equipment are not taken into account, as they assume that the licensing conditions are met and a particular HEI has the right and opportunity to train bachelors in this specialty.

Utilities per square meter of the laboratory are taken on average in Ukraine.

The list of laboratories and their characteristics are the minimum necessary for the formation of defined professional standards of relevant specialties in applicants. What is important is not the filling of laboratories with equipment, but the required number of engineering and laboratory staff and the area that determines the amount of part of utility bills.

RTS salaries are not taken into account, as it is assumed that all 60 annual credits for bachelor's degree training will be provided, regardless of the specialty.

In the diagram of **Fig. 4.1** illustrates the fact that a significant part of the cost of preparing a bachelor's degree does not depend on the specialty and therefore it can be ignored during the calculation $I_s$. These include university-wide costs and the costs of maintaining a non-specialized audience for the academic group and part of the lecture audience.

Each sector of this diagram contains all the annual costs of virtual HEI education for the preparation of an academic group of students majoring in the Resolution of the Cabinet of Ministers of Ukraine No. 1146.

We will not consider to determine $I_S$ all the costs associated with the formation of a bachelor's degree in a particular specialty, but only those that distinguish each of them from all others. This means that the costs are common, the same for all specialties are not taken into account. In **Fig. 4.1** is the cost from the middle of the chart.

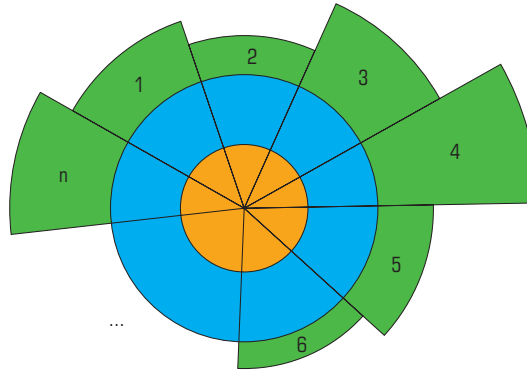



**Fig. 4.1** Illustration of the structure of expenses for training of academic group of students during the year for n specialties from the Resolution of the Cabinet of Ministers No. 1146. Each sector of this diagram contains all annual expenses of HEI for preparation of students for specialties 1…*n*. Sectors 1…6 illustrate specialties that have additional costs for the maintenance of specific laboratories according to the curriculum, and the remaining 7…*n* specialties do not provide for the presence of such laboratories

Thus, the economic justification of the specialty index ($I_s$) is proposed to be based on additional material costs that will be directed to the maintenance of special laboratories needed to ensure the formation of students' professional competencies, in accordance with the specialties of CMU Resolution 1146. Training of a specialist in one specialty to the corresponding cost of another is shown in **Fig. 4.2**.

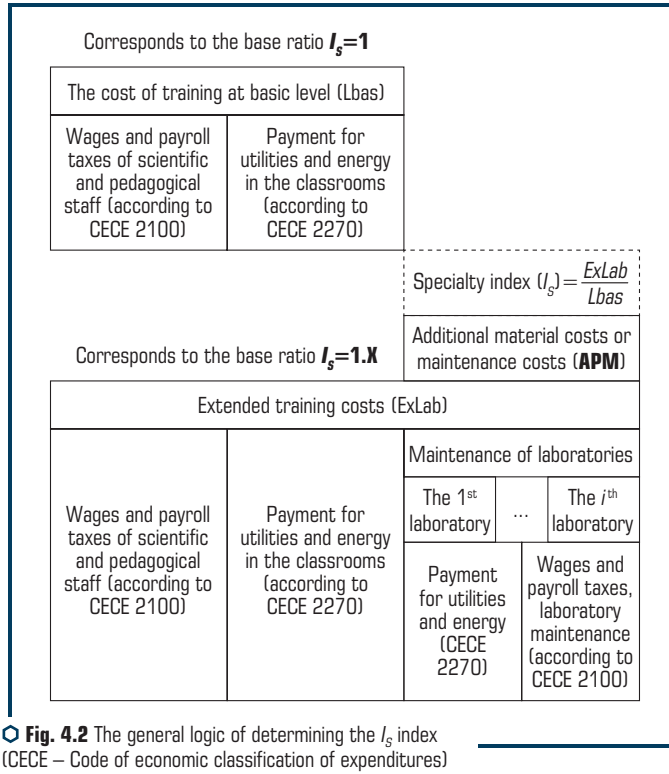



**Fig. 4.2** The general logic of determining the $I_S$ index (CECE – Code of economic classification of expenditures)

Under this approach, all specialties are proposed to be divided into three groups:

1. Specialties that require minimal material and personnel support. For such specialties set a single value of the specialty index ($I_S$=1).

2. Specialties that can be relatively easily distributed through the required number of additional laboratories (additional material costs are shown in **Fig. 4.2** as «maintenance costs»).

3. Specialties that require individual training. (As individual training involves the involvement of more teachers to train specialists, it is possible to calculate the cost of additional pay and maintenance of specialists (APM)).

These assumptions allow to form such a *method of economically justified determination of the value of the specialty index*. Within the limits of this technique offer passing of such stages.

*Stage 1* (for specialties of the first and second groups). Formation of a standard structure of HEIs as a list of laboratories required for the formation of special (professional) competencies within each of the specialties specified in the Resolution of the Cabinet of Ministers of Ukraine No. 1146. The formation of a standard structure can be implemented by the Ministry of Education and Science of Ukraine as a generalization of the proposals of several leading higher education institutions of the relevant profile from different regions of Ukraine. As a result of systematization of offers of HEI define a matrix of distribution of $k^{th}$ laboratories and $s^{th}$ specialties as it is resulted in **Table 4.8**.

**Table 4.8** Matrix of correlation of specialties required for the formation of professional competencies with the specialties (branch of knowledge – *BoK*) listed in the Resolution of the Cabinet of Ministers of Ukraine No. 1146

| **Specialties ($BoK_s$)** | **List of laboratories required to provide training ($LB_k$)** | | | | |
|---|---|---|---|---|---|
| | **$LB_{01}$ – «name»** | **$LB_{02}$ – «name»** | **$LB_{03}$ – «name»** | **...** | **$LB_m$ – «name»** |
| $BoK_{01}$ – education/pedagogy | | | | | |
| $BoK_{02}$ – culture and art | | | | | |
| … | | | | | |
| $BoK_{29}$ – international relations | | | | | |

In the cells given in **Table 4.8** matrix expert environment (representatives of educational and methodical commissions of Ukraine leading HEIs) describes the minimum required equipment of such laboratories, namely:

– number of staff (NS) required to ensure the smooth operation of the laboratory (persons);

– the minimum required area of the premises (RAP), which meets sanitary norms and other requirements ($m^2$);

– list of fixed assets required for the operation of the laboratory;

– materials used in the educational process (MP).

When forming the composition of laboratories and the list of necessary equipment, it is necessary to reflect the connection with the program learning outcomes specified in the standards of higher education.

*Stage 2* (for specialties of the first and second groups). The second stage is the optimization of the composition of laboratories on the basis of their uniqueness in terms of the formation of professional competencies. We introduce the following assumption. If the laboratory is present in each column of the **Table 4.7**, its presence corresponds to the basic funding and the value

of the index of specialty at level 1. Such laboratories for which $I_S=1$ are removed from the specified in **Table 4.8** lists.

*Stage 3* (for specialties of the first and second groups). Determination of additional material costs for the maintenance of unique in terms of formation of special (professional) competencies of laboratories. The cost of maintaining laboratories (CMLks) is calculated for the optimized matrix given in **Table 4.8**. The cost of maintenance is calculated only for unique laboratories ($ULB_k$). The assumption when determining such a cost is that the laboratories contain everything necessary for the training of equipment. This requirement was actually met at the licensing stage.

To the cost of maintenance, in accordance with the specified in **Fig. 4.2** logics belong to:

– remuneration and accrual of personnel involved in the maintenance of the laboratory and assistance to teachers in the implementation of the educational process ($ULB_{PR}$):

$$ULB_{PR}=\Sigma NS\times Salary\ with\ accruals; \quad (4.7)$$

– payment for utilities and energy required for the maintenance of the laboratory ($ULB_{KP}$):

$$ULB_{KP}=\Sigma NS\times The\ average\ cost\ of\ the\ leading\ HEIs\ and\ utilities\ per\ square\ meter\ of\ the\ laboratory; \quad (4.8)$$

– reasonable additional costs for the operation of the laboratory, such as, for example, water or chemical reagents ($ULB_{AC}$):

$$ULB_{AC}=\Sigma MP\ (average\ costs\ for\ materials\ and\ current\ financing\ of\ laboratories\ for\ laboratories\ of\ the\ leading\ HEIs\ of\ Ukraine). \quad (4.9)$$

The cost of maintaining unique laboratories is determined per calendar year:

$$CML=ULB_{PR}+ULB_{KP}+ULB_{AC}. \quad (4.10)$$

To calculate the quantitative values in **Table 4.9** for each unique laboratory in terms of the formation of professional competencies, from the expert environment (leading freelancers who provide training in the relevant specialty using the selected laboratory) should be obtained in aggregate form presented in **Table 4.10** information.

Information in **Table 4.10** can be formed, taking into account the minimum necessary standards set by experts, or taking into account the actual cost of operating the laboratory.

*Stage 4* (for specialties of the third group). These specialties do not provide for the use of unique laboratories. However, for these specialties part of the educational process is carried out individually, which leads to additional labor costs. That is, for these specialties, the *CM* indicator determines the additional costs of labor and accruals.

● **Table 4.9** Calculation of additional material costs in terms of knowledge (maintenance costs, CM)

| **Specialties ($BoK_s$)** | **List of laboratories required to provide training** | | | | | | **The average cost of maintaining unique laboratories according to the leading HEI** |
|---|---|---|---|---|---|---|---|
| | **Basic laboratories, which correspond $I_s=1$** | | | **Unique laboratories in terms of the formation of professional competencies** | | | |
| | ***LB* – «name»** | … | ***LB* – «name»** | ***ULB*$_{01}$ – «name»** | … | ***ULB*$_m$ – «name»** | |
| $BoK_{01}$ | – | … | – | $CM_{11}$ | … | $CM_{1m}$ | $CM_{01}=\sum_{i=1}^{m} CM_{01s}$ |
| $BoK_{02}$ | – | … | – | $CM_{21}$ | … | $CM_{2m}$ | $CM_{02}=\sum_{i=1}^{m} CM_{02s}$ |
| … | … | … | … | … | … | … | … |
| $BoK_{29}$ | – | … | – | $CM_{291}$ | … | $CM_{29m}$ | $CM_{29}=\sum_{i=1}^{m} CM_{29s}$ |

● **Table 4.10** Substantiation of costs for laboratory maintenance, for their inclusion in **Table 4.9**

**Laboratory «_____»**

**Staff costs per year**

| **Position** | **Tariff category** | **Salary with accruals** |
|---|---|---|
| | | |
| | | |
| Total | | $ULB_{PR}=$ |

**Maintenance costs during the year**

| **Expense item** | **Room area (m²)** | **Average costs for the leading HEIs per m² of the laboratory** | **Total** |
|---|---|---|---|
| Utilities | | | |
| Energy carriers | | | |
| Total | | | $ULB_{KP}=$ |

**The cost of operating the laboratory**

| **Materials and types of work that need funding** | **Justification of spending norms during the year** | **Costs** |
|---|---|---|
| | | |
| | | |
| Total | | $ULB_{KP}=$ |

**The cost for inclusion in the Table 8**

| | |
|---|---|
| Grand total ($CML=ULB_{PR}+ULB_{KP}+ULB_{AC}$) | $CM=$ |

The logic of calculating the *CM* indicator for these specialties is explained by the allocation of a relative increase in the number of teachers who provide the educational process. A visual representation of this logic is shown in **Fig. 4.3.** It is assumed that the cost of maintenance for the third group of specialties is an additional payment for individualized training.

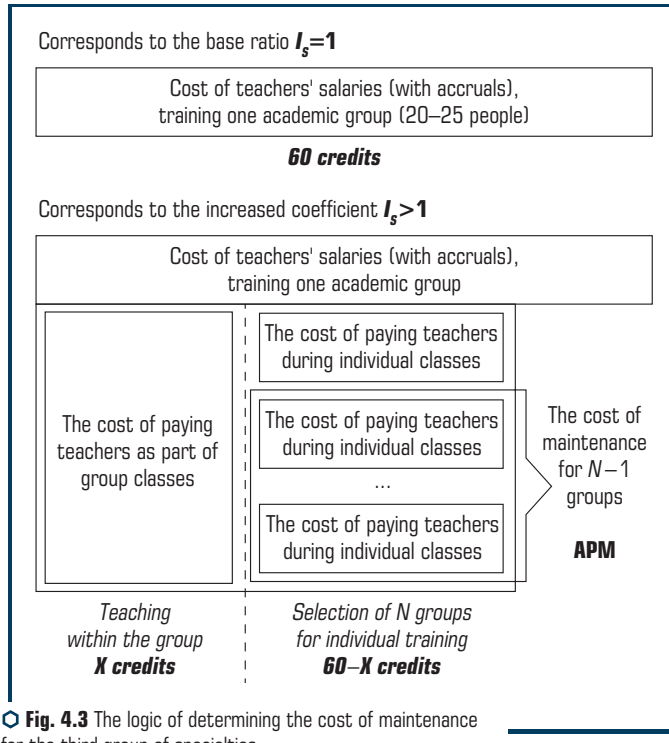



**Fig. 4.3** The logic of determining the cost of maintenance for the third group of specialties

The expert environment of the leading HEI should justify the number of subgroups that are allocated for individualized training during the period of preparation for different courses. This will determine the additional costs, which for comparison with other groups of specialties should be adjusted for one year (arithmetic mean is taken). The form for calculations is given in **Table 4.11**.

*Stage 5* (*for all specialties*). Provides for the transfer of the calculated costs of maintenance in the scale of the index of specialty on the basis of generalized data in **Table 4.12**.

Based on the **Table 4.12** determine the minimum ($CM_{min}$) and maximum ($CM_{max}$) value of maintenance costs.

**Table 4.11** Calculation of maintenance costs for the third group of specialties

| Educational programs, grades | Expenses for teachers' salaries per year for one group, thousand UAH | Number of subgroups | Number of credits for individualized training | The share of individualized training | Maintenance costs |
|---|---|---|---|---|---|
| | *Z* | *N* | *CR* | *ITS* *ITS*=*CR*/60 | *APM*=*ITR*×*Z*×(*N*–*1*) |
| Educational program «_____» | | | | | |
| I grade | | | | | |
| II grade | | | | | |
| III grade | | | | | |
| IV grade | | | | | |
| Educational program «_____» | | | | | |
| … | … | … | … | … | … |
| Expenses for additional payment and maintenance of specialists, *APM* | | | | | The average value for the 6th column |

**Table 4.12** Generalization of calculations

| Specialties ($BoK_s$) | Maintenance costs |
|---|---|
| $BoK_{01}$ – education/pedagogy | $CM_{01}$ |
| $BoK_{02}$ – culture and art | $CM_{02}$ |
| … | |
| $BoK_{29}$ – international relations | $CM_{03}$ |

Based on the minimum and maximum values of the specialty index introduced by the Resolution of the Cabinet of Ministers of Ukraine No. 1146, they offer:

– correlate the minimum value of maintenance costs with the index of the specialty at 1.2 ($I_S$=1.2 for $CM_{min}$);

– correlate the maximum value of maintenance costs with the index of the specialty at level 3 ($I_S$=3 for $CM_{max}$);

– proportionally distribute the specialty index for the rest of the calculated values of maintenance costs in steps of 0.1. That is, the cost of the scale step (*SS*) will be:

$$SS = \frac{CM_{max} - CM_{min}}{(I_{S\,max} - I_{S\,min}) \times 10}. \quad (4.11)$$

For each specialty, the coefficient is determined taking into account the obtained step of the scale according to the following scheme (**Table 4.13**).

● **Table 4.13** Formation of $I_s$

| $I_s$ | The initial value of the interval | The final value of the interval |
|---|---|---|
| 1,2 | $CM_{min}$ | $CM_{min}+(SS\times1)$ |
| 1,3 | $CM_{min}+(SS\times1)$ | $CM_{min}+(SS\times2)$ |
| 1,4 | $CM_{min}+(SS\times2)$ | $CM_{min}+(SS\times3)$ |
| … | … | … |
| 3 | $CM_{min}+(SS\times17)$ | $CM_{min}+(SS\times18)$ |

The specialty indices calculated according to the above method will be really economically justified.

When determining the estimated contingent is also used $I_l$ – the index of higher education level. It should determine the relative complexity and cost of training one specialist at a certain level of higher education for one year, regardless of the specialty. The value for the bachelor's level is taken as a unit.

The values $I_l = 1.3$ for the second (master's) level and $I_l = 0.8$ for the third (educational-scientific) level do not seem to be sufficiently substantiated. Substantiation of the values of this index is proposed on the basis of determining the *relative need for staff* (*RNS*) for the provision of educational services. The difficulty in comparing the three levels of higher education in this case lies in the different duration of study and the availability of the scientific component at the third level.

When determining the relative need for staff, it is assumed that part of the classes are conducted in groups (a total of *N*), and part – in the combined streams of lectures. Also in calculations provide correlation (depending on a kind of works) or with 450 contact hours on one rate of the teacher, or with 600 hours of the maximum loading on one rate of the teacher.

$$RNS = \frac{\text{The hours of lecture} \times \text{The number of streams } (M) + \text{The hours of practice} \times \text{The number of streams } (N)}{450 \text{ or } 600}. \quad (4.12)$$

The numerator of formula (4.12) is determined taking into account the following provisions:

– the distribution of classes within the ECTS credit is 30 % of classroom classes and 70 % of independent work (this ratio can be taken on average for both bachelor's and master's levels, regardless of specialties). That is, 30 % of the number of credits is *contact hours* (*CH*):

$$contact\ hours\ (CH) = 30\ \%\ \text{of}\ (ECTS\_Credits \times 30); \quad (4.13)$$

– in classroom work 50 % of classes – lectures that can be combined into *M* streams:

$$CH_{lecture} = CH \times 0.5; \quad (4.14)$$

$$CH_{practice} = CH \times 0.5; \quad (4.15)$$

$$RNS = \frac{CH_{lecture} \times M + CH_{practice} \times N}{450 \text{ or } 600}. \quad (4.16)$$

Next, focusing on a given logic, determine the value of the index of higher education level ($I_l$). Immediately note the following. During the year, the master's degree applicant receives 60 credits, which is equal to the number of credits for the bachelor's degree. However, for the university, the complexity and cost of providing such a number of loans at the master's level significantly exceeds the amount of these indicators at the bachelor's level. Lectures for bachelors are held for streams numbering from 50 to 150 applicants, and practical and laboratory – for an academic group of 25 applicants (sometimes, depending on the capacity of laboratories, 12–15 applicants). Whereas for masters lectures are held for 15 applicants (with a few exceptions – for 30–45 applicants), and practical and laboratory – for a maximum of 15 applicants.

Given the differences in the duration of training, it will be necessary to perform a number of calculations, which will calculate the relative need for staff (RNS) for a conditional 100 people with different levels of education.

*Calculation* 1. Comparison of RNS for bachelor and master within one year of study.

For 60 credits per year, the number of hours for both the bachelor's and master's levels will be 1,800 hours. Classroom work accounts for 540 hours:

$CH = 1{,}800 \times 0.3 = 540;$

$CH_{lecture} = 540 \times 0.5 = 270;$

$CH_{practice} = 540 \times 0.5 = 270.$

Assume that the flow of applicants at the bachelor's level is equal to 100 people in four academic groups of 25 people ($N=4$), combined into one stream ($M=1$):

$$RNS_{bachelor} = \frac{270 \times 1 + 270 \times 4}{450} = 3.$$

$RNS_{bachelor} = 3$ corresponds in its content to the provision of 3 rates of scientific and pedagogical staff.

At the master's level, 100 applicants is approximately seven master's programs ($N=7$) with the number of one program of 15 applicants (100/15). Each applicant from each of these master's programs must master (receive) 60 credits during the academic year. It is possible to unite applicants of different master's programs of more or less related specialties into streams of approximately 30–45 people only for half of the disciplines taught (i.e. provide for the allocation of three lecture streams $M=3$), otherwise lose the identity (independence) of programs and disappear meaningless their creation. For other disciplines classroom work is carried out in groups (15 applicants):

$$RNS_{master} = \frac{270 \times 3 + 270 \times 7}{450} = 6.$$

Thus, to ensure the educational process for 7 master's programs with a total number of applicants of 100 people requires in terms of complexity twice as much as the teaching rates:

$$I_l = \frac{RNS_{master}}{RNS_{bachelor}} = \frac{6}{3} = 2.$$

However, it should be taken into account that in order to ensure quality training of masters, it is necessary to attract more qualified teachers than for bachelors. In general, this means higher salaries through standard allowances for academic degrees and academic titles, encouraging allowances for teachers who are not entitled to such allowances but are class professionals. Taking into account all allowances, teachers' salaries for master's level must be at least 25 % higher than for teachers for bachelor's level.

Thus, taking into account the salary only at the expense of the teaching staff, the index of the master's level should be at least 2.5.

$$I_l = \frac{RNS_{master} \times \begin{matrix}\text{salary} \\ \text{supplements}\end{matrix}}{RNS_{bachelor}} = \frac{6 \times 1.25}{3} = 2.5.$$

Next, we compare the necessary material base, which should provide training for 100 applicants for bachelor's and master's degrees, regardless of specialty.

First, consider the necessary premises, preferably with multimedia equipment, laboratories, software, subscription to periodicals, updating the content of disciplines, the cost of utilities.

Bachelors need at least one lecture hall for 100 seats and four auditoriums with a capacity of 25 seats. In addition, depending on the specialty, a number of laboratories are required.

Masters require seven classrooms for 15 to 20 people and three classrooms for about 50 people. In addition, depending on the specialties, a number of special laboratories are required, but, compared to the bachelor's level, their number should be greater, as well as the complexity and cost of equipment.

Thus, it can be argued that the number of classrooms, multimedia equipment, the complexity of laboratory maintenance, the cost of software products, the complexity of developing content for academic disciplines, the cost of relevant utilities significantly exceeds the relevant bachelor's degree. It is almost impossible to quantify the excess of indicators in general for the master's level, but it can be estimated due to the difference in the cost of utilities.

However, even without this component, it is clear that the index of the master's level can not be less than 2.5.

In the current Resolution of the Cabinet of Ministers of Ukraine No. 1146, this index is equal to 1.3, which significantly reduces the estimated contingent, and hence the performance of HEIs, which have a significant percentage of applicants for a master's degree.

*Calculation* 2. Adjustment of calculation 1 for the duration of training.

The difficulty in comparing the RNS index for bachelor and master lies in the different duration of study and the different structure of student involvement in contact with teachers. Bachelor's degree is 4 years (8 semesters) and provides 240 credits. Assume that the eighth semester is devoted to writing a thesis (this is possible because it is also possible to take into account the availability of internships during the first years of study). Then the number of hours for bachelor's degree will be 6,300 hours (210 credits×30). Given the logic given in calculation 1, we obtain:

$CH = 6{,}300 \times 0.3 = 1{,}890;$

$CH_{lecture} = 1{,}890 \times 0.5 = 945;$

$CH_{practice} = 1{,}890 \times 0.5 = 945;$

$$RNS_{bachelor-4} = \frac{945 \times 1 + 945 \times 4}{450} = 10.5.$$

It should be noted that the RNS index coincides with the number of full-time units required for the preparation of bachelors only for the first calculation, as the calculation period is 1 year. In essence, the RNS is only a relative indicator that allows to compare the time and workload of teachers in the process of preparing applicants for different levels and forms of education.

To calculate the index of the level of education $I_l$ it is necessary to calculate the $RNS_{master}$. Here we assume that during the study of one bachelor is the release of three streams of masters. We also assume that the third semester of master's training is more focused on writing a thesis. Then:

$$I_l = \frac{RNS_{master} \times 3 \times \begin{matrix}\text{salary} \\ \text{supplements}\end{matrix}}{RNS_{bachelor-4}} = \frac{6 \times 3 \times 1.25}{10.5} = 2.1.$$

Within the specified adjustment we get the value of IR for the second level of education 2.1, in contrast to the index of the current version of the Resolution of the Cabinet of Ministers No. 1146, $I_l = 1.3$.

*Calculation* 3. Comparison of bachelor's and third (educational and scientific level) subject to training at each of these levels for 4 years.

The size of the index of the third level of higher education is significantly underestimated, because it is not easy to imagine that the annual complexity and cost of training one graduate student is 80 % of the training of one bachelor!

The third level of higher education is educational and scientific. As the name implies, it has two components: educational and scientific. In the current Resolution of the Cabinet of Ministers No. 1146 $I_r = 0.8$.

First, consider the educational component. Clause 26 of the Procedure for Training Applicants for Higher Education with the Degree of Doctor of Philosophy and Doctor of Science in Higher Education Institutions (Scientific Institutions), approved by the Resolution of the Cabinet of Ministers of Ukraine of March 23, 2016 No. 261 states that the curriculum of postgraduate studies disciplines should be 30–60 credits. To simplify the calculations, we will take the volume of the educational component of 50 credits, which can be distributed between the four years of training of a doctor of philosophy.

As for the bachelor's level, we assume that the number of applicants for educational and scientific level is equal to 100 people. Focusing on the volume of the state order for the training of scientific and pedagogical staff through postgraduate and doctoral studies in 2020, we can assume that on average higher education institutions recruit about 5 people for the educational program, who study in one group. Thus, we have 20 groups of graduate students ($N=20$).

Clause 27 of the Procedure for Training Applicants for Higher Education with the Degree of Doctor of Philosophy and Doctor of Science in Higher Education Institutions stipulates that the applicant of the third educational and scientific degree must master universal research skills, general scientific (philosophical) and language competencies. The volumes of this component are set in accordance with the standard of higher education. Assume that the training for this component is approximately 30 % of the total hours. We also envisage conducting lectures in groups of 25 people ($M=4$). Then in calculation for all educational components of preparation of the postgraduate student we receive:

$$CH=(50\times30)\times0.3=450;$$

$$CH_{lecture}=450\times0.3=135;$$

$$CH_{practice}=450\times0.7=315;$$

$$RNS_{postgraduate}=\frac{135\times4+315\times20}{450}=15.2.$$

Regarding the cost component of staffing quality postgraduate training, it is necessary to take into account the need to attract more qualified teachers than for bachelors, usually most of them are doctors of sciences, professors. In general, this means a higher salary due to standard allowances for the degree of Doctor of Sciences 33 % and the academic title of Professor 25 %. Taking into account all allowances, teachers' salaries for the educational and scientific level should be on average about 35 % higher than for teachers for the bachelor's level:

$$I_R=\frac{RNS_{postgraduate}\times\begin{matrix}\text{salary}\\\text{supplements}\end{matrix}}{RNS_{bachelor-4}}=\frac{15.2\times1.35}{10.5}=1.95.$$

Thus, taking into account the salaries of teachers, the index of the third level of higher education, taking into account only the educational component, should be approximately equal to 2.

Consider the complexity and cost of the scientific component of training a specialist in the educational and scientific level of higher education.

According to item 24 of the Order of preparation of applicants for higher education of the degree of Doctor of Philosophy and Doctor of Science in higher education institutions, 50 academic hours of academic workload are allocated to the research supervisor annually for scientific supervision of work on the dissertation of one graduate student (adjunct). Under the conditions of training of 100 applicants for higher education of the third educational and scientific level, the annual total cost is 5,000 hours. Since the term of study is 4 years – we get 20,000 hours. Here we will focus on the maximum study load of 600 hours defined by the Law of Ukraine «On Higher Education». Accordingly, the value of the RNS indicator to ensure the scientific component of postgraduate training should be 33.3 (20,000/600=33.33). Let's make the appropriate adjustment of the previously defined calculation of the index $I_l$ for the third level by adding a scientific component:

$$I_l = \frac{(15.2 + 33.3) \times 1.35}{10.5} = 6.2.$$

Since applicants for the third level of higher education are expelled from graduate school after passing a professional seminar, the scientific component can be limited to three years of training. Then there will be 15,000 hours per 100 people ($RNS$=15,000/600=25). Given this adjustment we get:

$$I_l = \frac{(15.2 + 25) \times 1.35}{10.5} = 5.1.$$

Thus, the reasonable value of the education level index for the third level of higher education should be 5.1, in contrast to the current version of the Resolution of the Cabinet of Ministers No. 1146, in which $I_l$=0.8.

Next, we note that $I_f$ is the index of the form of education for distance and distance learning is unreasonably reduced.

We also propose to calculate this index taking into account the indicator of relative staffing needs (RNS). But this indicator will be calculated, taking into account not the number of credits, but the number of contact (classroom) hours of part-time students. The definition of such hours is regulated by the Guidelines for the implementation of the European credit transfer system and its key documents in higher education institutions developed by the Ministry of Education and Science of Ukraine (Letter No. 1/9-119 dated 26.02.2010). To substantiate the IF index, we compare the indicator of the relative need for staff for four years of bachelor's training with the corresponding indicator for distance learning, given that the period of distance learning will be more than 4 years.

Thus, paragraph 11 of these guidelines establishes that during the sessions part-time students have the same weekly time budget as full-time students (54 hours). At different years of training, the duration of the session can be from 30 to 40 days, depending on the schedule of the educational process of a particular HEI. To perform calculations, take the example of the distribution of hours given in the guidelines. The duration of the session in the first, second and fifth years of study is 30 days, and in the third and fourth – 40 days. That is, the duration of sessions for the entire period of preparation of the bachelor in distance learning is 170 days or about 24 weeks. Given the requirement of 54 hours of training per week, we get the number of contact hours (*CH*) 1,296 (24×54). In accordance with the above logic of the distribution of contact hours between lectures and practices (in the case of correspondence – between the arrival of applicants for higher education to study) we get:

$CH = 1{,}296;$

$CH_{lectures} = 1{,}296 \times 0.5 = 648;$

$CH_{practice} = 1{,}296 \times 0.5 = 648;$

$$RNS_{correspondence\ form} = \frac{648 \times 1 + 648 \times 4}{450} = 7.2.$$

To calculate the index of the form of education, this indicator must be correlated with the relative need for staff for four years of bachelor's degree:

$$I_F = \frac{RNS_{correspondence\ form}}{RNS_{bachelor-4}} = \frac{7.2}{10.5} = 0.68.$$

Note that for distance learning, the actual volume of students is much smaller than full-time, respectively, it is necessary to make adjustments to this calculation, assuming the presence of at least two lecture streams ($M = 2$). Then we get the following:

$$RNS_{correspondence\ form} = \frac{648 \times 2 + 648 \times 4}{450} = 8.6;$$

$$I_F = \frac{RNS_{correspondence\ form}}{RNS_{bachelor-4}} = \frac{8.6}{10.5} = 0.82.$$

Thus, we propose to set the value of the index of the form of education for distance and distance form at the level of 0.8 ($I_F = 0.8$). In the current version of the Resolution of the Cabinet of Ministers of Ukraine No. 1146, this index was equal to 0.3, which significantly underestimated the overall size of the estimated contingent of a certain HEI.

It should also be noted that quality training by correspondence (distance) form of education requires the development of quality learning management systems (LMS). Given the significant percentage of hours that belong to independent work, the creation of such knowledge management systems and the content of their content is a significant burden on the teacher. This complexity is another reason for increasing the value of the index of the form of education.

### 4.3.2 JUSTIFICATION OF THE LIST AND SIZE OF INDICATORS FROM THE FORMULA FOR THE DISTRIBUTION OF BUDGET FUNDS

Let's consider in more detail each of the indicators that form the performance indicator of a particular HEI. First of all, it should be emphasized that the purpose of the Resolution of the Cabinet of Ministers of Ukraine No. 1146 is not to determine the cost of training specialists with higher education, but only the distribution of the already determined amount between HEIs. Thus, it is a question of a relative estimation of activity of certain HEI concerning others. This integrated indicator ($A_i$) should be based on indicators that allow to assess the advantages of a particular HEI over others and to indicate to management the directions for improving the functioning of HEIs.

One of the main requirements for the list of such indicators is the ability to determine its size for each HEI on the basis of objective data from official reports, rather than from the results of self-assessment. This is the first requirement.

The second requirement should be the possibility of a comprehensive assessment of both educational and scientific activities, and educational activities of the HEI. This is important because, according to the principles of MagnaChartaUniversitatum, HEI should be not only a scientific and educational, but also a cultural center in society.

Finally, the third requirement. The system of these indicators should take into account the assessment of a particular HEI by external stakeholders or customers of educational services. Their high appreciation of a particular HEI ensures its co-financing from both employers and students and their parents. This is a significant help to the state in financing higher education. Of course, the interests of the state also include obtaining funding for higher education from foreign investors.

All financial revenues to the HEI from external stakeholders are economically and actually beneficial to the state as a whole, as they provide an opportunity to improve the material base of higher education. This ultimately improves the quality of training for professionals with higher education.

Consider each indicator of the Resolution of the Cabinet of Ministers No. 1146, taking into account the previously formulated requirements for indicators.

Indicator of the level of scale of a certain institution of higher education [18], which establish, depending on the actual number of applicants for higher education by state order in such institution, as of October 1 of the previous calendar year, according to official reports .

The first requirement is fulfilled unquestioningly.

The second requirement is fulfilled only partially. Indeed, the larger the number of HEI in terms of contingent and the number of branches in which specialists with higher education are trained, the more opportunities there are to organize the educational component of the educational process. The organization of artistic events on the basis of own amateur performances in various fields allows to objectively raise the general cultural level of students. The richness of cultural life in the student years creates a strong foundation for the intellectual development of the specialist and his/her family in the future.

However, the developers of the Resolution of the Cabinet of Ministers of Ukraine No. 1146 for some reason limited the scale of HEIs only to students studying by state order. Contract students have no less the right to the educational component of the activity of the HEI. The state of Ukraine is interested in highly cultured specialists with higher education. Moreover, in recent decades, the development of the material base of the HEI is provided by almost 90 % at the expense of a special fund, which is formed at the expense of these students.In addition, large HEIs have advantages such as reduction of conditionally fixed costs for administrative and economic activities, concentration of the best research and teaching staff (*RTS*) in powerful specialized departments, availability of the possibility to equip laboratories with modern equipment, etc. However, there is no doubt that all these benefits only increase with the growth of the contingent of contract students.

In addition, the increase in the number of contract students indicates an increase in the authority of a particular HEI in society. This became especially relevant after the introduction of the Resolution of the Cabinet of Ministers of Ukraine No. 191 on the indicative cost of training, which significantly reduced the possibilities of dumping. This resolution needs to be revised, as it has reduced, but not eliminated, the possibility of establishing an undervalued tuition fee.

Thus, the third requirement is not fully met, as it does not take into account the interests not only of employers and students, but also the state to attract additional funding.

The inclusion in the calculation of the scale of a certain institution of higher education $S_i$ of the entire contingent of students, not just those who study by public order, will fully meet all three requirements for indicators that characterize the effectiveness of HEI activity.

It is also important that the HEI management is thus given a guideline for work, as the calculation of the scale indicator based on the total contingent of applicants will direct their efforts not only to increase the number of students in budget form of education, but also to attract the maximum number of contractors. Increasing the number of applicants studying at the expense of individuals and businesses is, of course, in the interests of the state. In this way, co-financing of higher education is provided.

It is proposed to divide the number of applicants for HEIs, regardless of funding sources, as of October 1 of the previous calendar year, according to official reports, into 5 intervals:

– 1 – 3,000;
– 3,001 – 6,000;
– 6,001 – 10,000;
– 10,001 – 15,000;
– more than 15 thousand people.

The level of scale of a particular institution of higher education $M_i$ is set for the first interval of 0.8, and then, respectively, 1.0; 1.1; 1.2; 1.3.

In **Fig. 4.4** shows a diagram of the distribution of HEIs at certain intervals in the number of applicants for higher education.

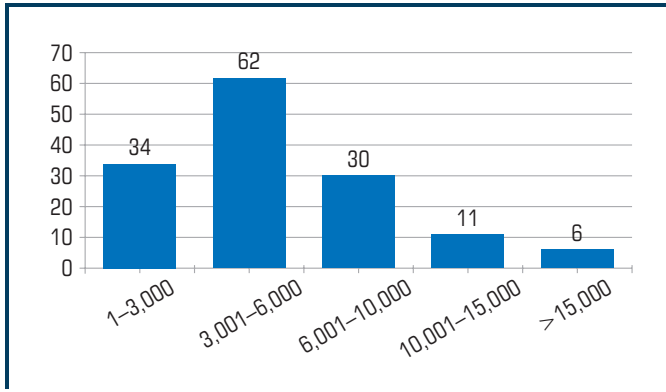



**Fig. 4.4** The diagram of distribution of HEIs on the size of a contingent of applicants of higher education

So:

– 34 HEIs will have a scale indicator of 0.8;

– 62 HEIs will have a scale indicator of 1.0;

– 30 HEIs will have a scale indicator of 1.1;

– 11 HEIs will have a scale indicator of 1.2;

– 6 HEIs will have a scale factor of 1.3.

According to the current version of the Resolution of the Cabinet of Ministers No. 1146, the level of scale of a certain higher education institution $M_i$ is set, depending on the actual number of applicants for higher education by state order in such institution, as of October 1 of the previous calendar year, according to official reports, it is:

– 0.8 – for institutions where this figure is less than 1,000;

– 1.0 – for specialized art and sports institutions, relocated institutions, as well as for institutions where such an indicator is in the range of 1,000–2,999;

– 1.2 – for institutions with such an indicator in the range of 3,000–5,999 people;

– 1.4 – for institutions with such an indicator in the range of 6,000–9,999 people;

– 1.5 – for higher education institutions with such an indicator of at least 10,000 people.

In the following diagram (**Fig. 4.5**) the variable «the actual number of applicants for higher education by state order as of October 1, 2019» is divided into intervals, in accordance with the Resolution of the Cabinet of Ministers No. 1146.

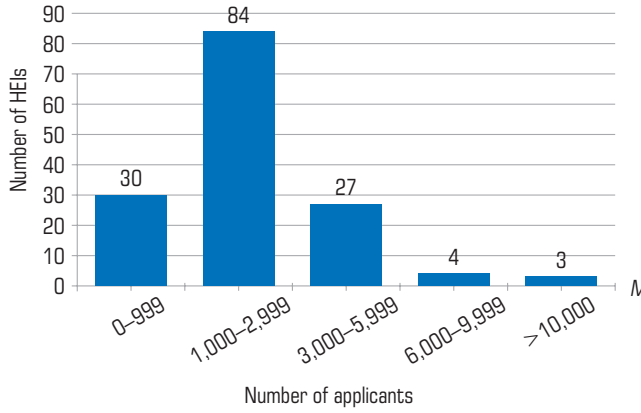



**Fig. 4.5** Distribution of HEIs of Ukraine in terms of the actual number of applicants for higher education by state order in a particular institution as of October 1, 2019.
*Note: 1) along the ordinate axis – the number of HEIs; 2) on the first axis abscissa – the actual number of applicants for higher education at intervals, according to the Resolution of the Cabinet of Ministers No. 1146; 3) on the second axis abscissa – indicator=0.8; 1.0; 1.2; 1.4; 1.5*

The histogram shows how unevenly the HEIs of Ukraine are distributed in terms of the number of applicants studying under the state order.

According to the reported data (**Fig. 4.5**):

– 30 HEIs have an underestimated indicator – an indicator of the level of scale, which is equal to 0.8;

– 84 HEIs (56.8 %) have a scale indicator equal to 1;

– 27 HEIs (18.2 %) have a scale indicator equal to 1.2;

– 3 HEIs have the highest scale of 1.5.

Consider how the value of the level of scale affects the part of the fund that is distributed, according to the performance of a particular institution of higher education (FRA), which is one unit of the estimated contingent for all other similar indicators.

In the proposed wording, the difference in the impact on the performance of the HEI from the lowest to the highest is 0.5, and from the most numerous clusters the difference is 0.3. According to the proposed methodology of the current version of the Resolution of the Cabinet of Ministers No. 1146, the smallest HEI for each unit of the estimated contingent will receive 50 % less funds than the largest HEI. Whereas each HEI from the largest cluster will receive 30 % less for each unit of the estimated contingent than the largest HEI.

The situation is completely different in the case of implementation of the current version of the Resolution of the Cabinet of Ministers No. 1146: three HEIs (the largest) will have from the fund,

which distributes, according to the performance of a higher education institution, FRA for each unit of the contingent is 70 % more funds than the HEI from the first cluster (the lowest HEIs). And the HEIs from the largest cluster will receive 50 % less funds for each unit from the settlement contingent than each of the three HEIs from the cluster (the largest HEIs). It should be emphasized that we are talking about one unit of the estimated contingent, and their number in each of the above HEIs, obviously, differ significantly, so the amount of funding will be tens of times the difference.

In other words, a «softer» clustering of HEIs is proposed, compared to the current version of the Resolution of the Cabinet of Ministers of Ukraine No. 1146. In the current version, the «black-and-white» variant is declared. The three HEIs will have an exclusive advantage over other HEIs.

Of course, it is necessary to stimulate the management of HEI to increase their level of scale. One of the methods of such a movement is to unite related in the aspect of specialties HEI. This is especially effective for HEIs, which train specialists in technical specialties, the training of which requires a powerful modern laboratory base. In the joint HEIs, which will recruit at least 50–75 applicants for the bachelor's degree in such specialties, there are more opportunities to ensure the renewal of logistics. In contrast to the situation when each HEI is not able to recruit even 10 people according to the formula: budget+contract (see section 3 of this monograph **Table 3.9**).

However, as the practice of application of the Resolution of the Cabinet of Ministers of Ukraine 1146 in 2020 has shown, the academic community has a real opposition to harsh approaches such as «black and white». This is especially noticeable when the transition from abstract conversations to specific actions that affect personal interests. Therefore, in the author's opinion, softer «clustering» based on public opinion will be more effective.

The indicator of the level of scientific activity of a higher education institution $Sc_i$ is really important, given the need to stimulate scientific work by scientific and pedagogical workers, as it is impossible to imagine how a teacher who is not engaged in scientific work can instill in students a taste for research and teach students. synthesize new knowledge.

According to the Resolution of the Cabinet of Ministers of Ukraine No. 1146 for higher education institutions that have no income to the special fund based on the results of scientific and scientific-technical activities on international cooperation projects and economic agreements (as of December 1 of the previous calendar year on average for the last three years), the value is 1.0.

According to the current version of the Resolution of the Cabinet of Ministers of Ukraine No. 1146, in fact 30 HEIs did not have a single hryvnia of the special fund based on the results of scientific and scientific-technical activities on international cooperation projects and economic agreements for the last three years.

In addition, 25 HEIs had the amount of revenues to the special fund based on the results of scientific and scientific-technical activities on international cooperation projects and economic agreements reduced to the number of scientific and pedagogical staff in higher education up to UAH 500.

Thus, in fact, in 2020, 55 HEIs received an indicator $Sc_i=1.0$.

Values of 1.1 are given for institutions of higher education, in which the amount of income to the special fund on the results of scientific and scientific-technical activities on projects of interna-

tional cooperation and economic agreements, reduced to the number of scientific and pedagogical staff in higher education, is from 1 to 2,000 UAH.

In fact, in 2020, 32 HEIs received the value of the indicator $Sc_i$=1.1 in terms of the corresponding revenues to the special fund in the amount of UAH 500 to 2,000.

Correspondence of the indicator $Sc_i$ to the volume of receipts to the special fund, according to the Resolution of the Cabinet of Ministers of Ukraine No. 1146 is as follows:

– 1.2 – from UAH 2,001 to 5,000;
– 1.3 – from UAH 5,001 to UAH 10,000;
– 1.4 – from UAH 10,001 to UAH 20,000;
– 1.5 – over UAH 20,001.

According to the actual data for 2019 [18], we calculate the distribution of HEIs on the basis of revenues to the special fund by the results of scientific and scientific-technical activities, which have already been mentioned earlier (**Fig. 4.6**).

Given the importance of stimulating the scientific and pedagogical staff of the HEI to scientific activity, it would be logical to determine the indicator of scientific activity by the example of the scale indicator.

For example, for HEIs that have revenues to the special fund based on the results of scientific and scientific-technical activities under international cooperation projects and economic agreements, reduced to the number of scientific and pedagogical workers from 0 UAH to 500 UAH, provide $Sc_i$=0.8; from UAH 500 to UAH 3,500 – $Sc_i$=1.0; from UAH 3,501 to UAH 6,500 – $Sc_i$=1.2; from UAH 6,501 to UAH 9,500 – $Sc_i$=1.3; more than UAH 9,501 $Sc_i$=1.4.

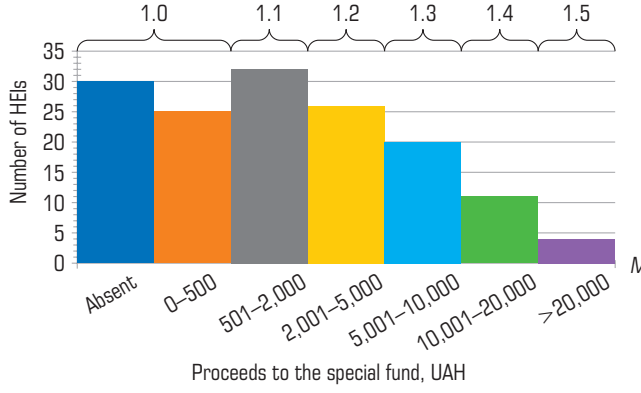



**Fig. 4.6** Diagram of the distribution of HEIs by intervals of receipts to the special fund based on the results of scientific and scientific-technical activities on international cooperation projects and economic agreements, reduced to the number of scientific and pedagogical workers in higher education (UAH) and the second abscissa institution of higher education $Sc_i$

However, the system of accounting for the amount of research expenditures currently in use is unconvincing. Not all scientific and technical developments of scientists are in demand among businesses and especially in a socio-economic crisis. Moreover, the commercial implementation of developments in the field of basic sciences in general can be postponed indefinitely. However, all scientific and technical developments, of course, are useful for improving the content of relevant disciplines and for the formation of applicants' skills in research, which provides high quality training for professionals with higher education.

In addition, specialists of different specialties have different opportunities in the market of scientific services. For example, within the framework of the road construction program, significant funds are allocated in the budget, which makes it possible to order scientific developments from universities on a contractual basis, while it is impossible to order such developments in the field of pedagogical sciences from government agencies!

Thus, it is almost impossible to take into account all aspects of scientific activity of a particular HEI, regardless of the specialties that are characteristic of it. In fact, in view of this, when considering the system of indexes of specialties, it is proposed to introduce an index of state support $StS(s)$, just for the specialty, and not HEI in general.

Consider the compliance of this indicator with the requirements formulated earlier.

The first requirement is fulfilled in full.

Regarding the second requirement, it can be argued that it is partially fulfilled, because the more external financial revenues to the HEI, the more opportunities students have to participate in team research. Such participation ensures, among other things, the formation of a high level of emotional intelligence and, in particular, «soft competencies» or softskills.

The third requirement is only partially fulfilled, as this indicator takes into account the assessment of a certain HEI by external stakeholders due to the size of business agreements for the implementation of scientific and design developments. However, this indicator does not fully take into account the assessment of HEI by the world expert community. Funding is taken into account only within the «Horizon Europe» program, which is treated as scientific.

Of course, this is not in the interests of Ukraine, as attracting foreign investment in the framework of international cooperation to finance the activities of the HEI is objectively aimed at improving the quality of higher education and saves the general fund budget. Moreover, international programs such as ERASMUS+ and AUF (Agence universitairedela francophonie) fund only those projects that have been very meticulously selected. Thus, the HEIs that have received funding, of course, have authority in the international scientific and educational community. It is impossible to imagine that these programs would finance low-level HEIs in terms of the development of scientific and pedagogical staff.

Typically, projects funded under these programs are scientific and technological in nature and aimed at improving the quality of higher education. The fact that they do not belong to the current classification of scientific developments, in fact, can not be a reason to ignore them when evaluating the achievements of a particular HEI, in terms of saving the general fund of the budget for higher education. Moreover, ignoring the importance for HEI and the state in general of receiving

funding under these programs really demotivates RTS, as it devalues their significant intellectual and creative efforts spent in the preparation of relevant projects.

Thus, the decision to take into account this funding when determining the size of the indicator of the level of scientific activity of a higher education institution will be more reasonable $Sc_i$.

However, this indicator can in no way take into account the assessment of a particular HEI by customers of educational services! Whereas such an assessment is very important for the state. Successful HEIs need to be financed from the general fund of the state budget, those that are able to provide co-financing of their development at the expense of their own special fund! World practice shows that investing in projects that do not have co-financing from the stakeholder is usually not effective! Research on the materials of 2019 showed [18] that the management of not all HEIs directs its special fund for development. The state's investment from the general fund of the budget of such HEIs will only stimulate the maintenance mood and will not ensure their development.

Evaluation of the results of the work of HEIs by customers of educational services can be carried out by an indicator calculated by the ratio of the size of the special fund of HEI, formed by tuition fees to the number of RTS on a certain date of the previous year. This indicator will show the level of authority of a particular HEI in society. It shows how much students and their parents trust this or that HEI. In other words, they vote with their own funds for a certain HEI. This indicator can be called as «an indicator of the popularity of free trade» – $P_i$. Its participation in the formation of an integrated indicator of the activity of the HEI ($A_i$) will make it possible to more adequately assess the advantages of a particular HEI over others.

The $P_i$ size should be set from five values – from 1.0 to 1.4, and the measurement scale should be calculated based on the actual reporting data for the previous year. To do this, take the minimum and maximum size $P_i$ and divide the difference into five intervals. For example, if the minimum value is UAH 10,000 and the maximum value is UAH 400,000, it will be correct to set the following scale:

– 0 – 80 thousand UAH size $P_i$=1.0;
– 81 – 160 thousand UAH size $P_i$=1.1;
– 161 – 240 thousand UAH size $P_i$=1.2;
– 241 – 320 thousand UAH size $P_i$=1.3;
– 321 – 400+ thousand UAH size $P_i$=1.4.

The first requirement for indicators is fulfilled in full, as the actual data for each HEI are taken from the official reporting.

The second requirement is fulfilled in part, because the more external financial revenues to the HEI, the more opportunities to improve the material base for artistic events, amateur performances, sports and more. The participation of students in such activities ensures the formation of a high level of emotional intelligence, enhancing their cultural development and improving «soft competencies» or softskills.

The third requirement is fully met if we consider together the indicators of the level of scientific activity of the higher education institution $SC_i$ and the popularity indicator of the HEI $P_i$, as they

fully take into account the assessment of a certain HEI by external stakeholders or customers of educational services. If the assessment of a certain HEI is high, then co-financing of its development is provided both by employers and by students and their parents. Of course, the interests of the state also include obtaining funding for higher education from foreign investors.

An indicator of the level of international recognition equal to 1.1 for higher education institutions included in the TOP–1,000 of one of the international rankings (without division into faculties, specialties, etc.): QS World University Rankings, and/or The Times Higher Education World University rating Rankings, and/or Academic Ranking of World Universities – WorldTop 500 Universities, or 1.0 in other cases (taking into account the latest version of the ratings, officially published by December 31 of the previous calendar year).

An indicator of the level of international recognition $IR_i$ equal to 1.1 for higher education institutions included in the TOP–1,000 of one of the international rankings (without division into faculties, specialties, etc.): QS World University Rankings, and/or The Times Higher Education World University rating Rankings, and/or Academic Ranking of World Universities – WorldTop 500 Universities, or 1.0 in other cases (taking into account the latest version of the ratings, officially published by December 31 of the previous calendar year).

This is a very important indicator that ultimately forms the international public opinion about the system of higher education in Ukraine, but to use a binary number system («yes – no») to form the indicator is not sufficiently justified. If we recognize that Ukraine does not have high–quality own rating systems, then there are a sufficient number of unbiased systems in the world that will make it possible to establish at least a 3–4-level gradation of HEI.

For example, for HEIs that do not have rating positions $IR_i = 1.0$; for HEI included in QS REGIONAL $IR_i = 1.1$; for HEIs included in QS WorldUniversityRankings, and/or The Times Higher Education World University Rankings, and/or Academic Ranking of World Universities – World Top 500 Universities $IR_i = 1.2$.

The first requirement is fully met by this indicator, as it is based on official data.

The second requirement is partially met, as indirectly high values of this indicator motivate foreign universities to cooperate with domestic HEIs, which provides our teachers and students with international academic mobility. Such mobility provides an increase in the professionalism of our teachers. It not only strengthens the professional competencies of students, but also increases their emotional intelligence, broadens their horizons.

The third requirement is also partially met, as it indirectly encourages external stakeholders to co-finance domestic higher education. Increases, in particular, the number of foreign students in domestic HEIs, which not only increases the size of the special fund of HEIs, but also provides investment in the country's economy. This is understandable, because foreign students not only pay for their education. They actually invest in the catering system, leisure infrastructure and indirectly in the construction of housing through rent.

Thus, with the appropriate adjustment, this indicator really characterizes the efficiency of a particular HEI and can be part of an integrated performance indicator $A_i$ of a certain HEI.

The indicator of the level of regional support of a certain institution of higher education $RS_i$, which in the current Resolution of the Cabinet of Ministers of UkraineNo. 1146 is:

– 1.0 – for higher education institutions located in Kyiv;

– 1.03 – for higher education institutions located in Lviv and Kharkiv;

– 1.07 – in other cases.

This indicator has no justification at all. Its meaning is clear – the state financial support of regional HEIs, because the larger the size of this indicator in a particular HEI, the more funds will be allocated from the general budget. Each HEI has several sources of funding in the educational part of its activities, among them, firstly, funding from the general fund of the budget and, secondly, payment for educational services that it provides to customers. Indeed, there is a real regional difference in the income of the population, which determines the regional level of solvency. Thus, regional HEIs have less opportunities to fill their special fund for, for example, HEIs of the city of Kyiv. Therefore, the introduction of a regional support indicator seems necessary.

The enactment of the Resolution of the Cabinet of Ministers of Ukraine No. 191 on the indicative cost of education services has significantly reduced the possibilities of dumping, which was a very common phenomenon until 2020. This resolution has significant shortcomings, but still regulates the formation of prices for educational services, in particular in the regional aspect.

Thus, the average cost of educational services by region can be a more or less objective integrated indicator of solvency in education. In contrast, for example, to the average wage, which does not take into account informal household income. In this regard, it is proposed to link the size of the indicator of the level of regional support of a certain higher education institution $RS_i$ from this region ($k$) to the average annual cost of educational services for higher education in the previous year. To clarify, it is possible to use the weighted average cost by specialties and levels of education.

In addition, it is proposed to increase the weight of this indicator in the integrated performance $A_i$ of a particular HEI. To do this, it is necessary to increase its variability to at least 0.2 units. This means that its minimum value is 1.0, while the maximum value is 1.2.

Offered:

– correlate the minimum value of the average value of $C_{min}$ from regions ($k$) with =1.1 for HEIs from this region;

– correlate the maximum value $C_{max}$ of $RS_i$=1.0 for the HEI of the respective region;

– proportionally distribute the value of the indicator of the level of regional support of a certain higher education institution $RS_i$ from 1.0 to 1.1 in steps of 0.02 at six intervals, according to the average annual cost of educational services for higher education in the previous year in the region.

The distribution of the six values $RS_i$ from 1.0 to 1.1 by region is as follows.

First, calculate the difference between the maximum and minimum average value, which is divided into six intervals. Then each of these intervals is assigned the value of regional support of the region ($k$) from 1.0 to 1.1 in steps of 0.02. Finally, the level of regional support $RS_i$ for a particular higher education institution is assigned to each HEI in the region.

The indicator of the level of regional support of a certain higher education institution $RS_i$ in the proposed form meets the first requirement for indicators, because, unlike the version of the Resolution of the Cabinet of Ministers of Ukraine 1146, it is calculated on the basis of objective data from official reports.

The second requirement regarding the educational component of the educational process is also partially fulfilled, because the more revenue from the general fund of the budget will be in a regional HEI, the more opportunities to improve the material base for artistic events, amateur performances, sports and more. The participation of students in such activities ensures the formation of a high level of emotional intelligence, enhancing their cultural development and improving «soft competencies» or softskills.

The third requirement for indicators that assess the performance of a particular HEI in relation to the level of regional support for a particular institution of higher education $RS_i$ is not met by definition. Of course, since its size characterizes the HEI not in terms of its activities, but only in relation to a particular region.

Indicator of the level of employment of graduates of a certain institution of higher education $LEG_i$, which has not been used in the current year, it can become a really objective bright indicator of both the quality of competencies of graduates and the structure of graduates in terms of specialties.

This indicator will meet the first requirement if its size is formed for each HEI on the basis of objective data from official reports, and not from the results of self-assessment.

The second requirement will be fully met, as the recruitment assesses not only the professional component of the training, but also the level of emotional intelligence, in particular the formation of «soft competencies» or softskills. A significant role is also played by the level of cultural development of the applicant for a job that requires higher education.

Finally, the third requirement of this indicator is met in full, as it directly assesses the quality of training by certain employers. In fact, this is one of the main indicators of the effectiveness of the HEI.

Thus, the analysis of the set of indices and indicators used in the Resolution of the Cabinet of Ministers of Ukraine 1146 indicates the urgent need to refine it. The formulaic approach, which was declared in the process of preparation of this resolution, remains only a fashionable motto, as it is not based on economic calculations and does not direct the management of HEIs to improve the efficiency of educational institutions.

If do not change the structure of the indices and do not introduce an additional index of state support for specialties necessary for the strategic development of the state, this resolution will not give the expected effect. In fact, its operation during 2020 confirms this thesis.

The system of indicators that should assess the quality or efficiency of the functioning of the HEI does not provide a systematic assessment. The authors of the 2020 development stated the following:

– priority funding from the general fund will be received by the HEI with a contingent of applicants studying under the state order, in the amount of more than 10 thousand people with a coefficient of 1.5;

– the assessment of external stakeholders is taken into account only for the investment of scientific and technical developments, executed in the form of economic agreements and international agreements in the scientific field;

– the rating by international rating systems is taken as «yes – no» or «black – white».

It is not easy for the HEI to develop an effective development strategy within such limits.

Given the limited public funding for higher education, every effort should be made to obtain co-financing from external stakeholders. The developers of the Resolution of the Cabinet of Ministers of Ukraine No. 1146 did not pay attention to such a significant aspect of the activity of the HEI as training. Investments from international institutions in improving the quality of initial work are not taken into account, and therefore not encouraged. Thus, lose part of the co-financing, significant assistance to the state. They also do not encourage co-financing from customers of educational services, although it is undeniable that the most popular HEIs provide their development with a special fund formed by the payment of external stakeholders for training. Therefore, the introduction of the popularity index of HEIs is an economically justified measure.

Thus, it is necessary to make the following changes to the Resolution of the Cabinet of Ministers No. 1146:

– to determine the estimated contingent of applicants for higher education who study on the terms of the state order in a particular HEI ($CCO_i$), to carry out according to formula (4.3), where the index of state support $StS_i$ is introduced, its size is determined by a separate method;

– the size $I_l$ – the index of the level of higher education, $I_f$ – the index of the form of education, $I_S$ – the index of the specialty to be determined according to the methodology given in these proposals;

– the formula for calculating the size of the indicator of activity of a certain institution of higher education ($A_i$) taking into account the indicator of profiling and the indicator of popularity of HEI ($P_i$) has the following form:

$$A_i = AN_{sfli} \cdot IP_i \cdot S_i \cdot RS_i \cdot Sc_i \cdot IR_i \cdot LEG_i \cdot P_i. \qquad (4.17)$$

The calculation of the size of each indicator from formula (4.17) should be performed according to the proposed approach.

In general, with such revision, the Resolution of the Cabinet of Ministers of Ukraine No. 1146 can be effective in the distribution of state budget expenditures between higher education institutions, while the calculation of the amount of expenditures required for the development of higher education remains outside its scope.

The development of the system of financing higher education in Ukraine should be based on joint calculations of the state order for specialists with higher education and necessarily in combination with the Rules of Admission to Higher Education. This should be the only system where the leading element is the state order, then the financing of higher education, then the Rules of admission to the institution of higher education.

# CONCLUSIONS

Problems of development of the education system of Ukraine are largely due to socio-economic and demographic circumstances, which in turn depend on the socio-political situation in the country. The wave-like changes in the components of the demographic situation in Ukraine and their connection with the waves of chain changes in GDP are clearly traced.

The socio-political situation in Ukraine changed in accordance with such system-forming processes as gaining independence, building a national political system, privatization, transition to market relations, introduction of national currency, global economic crisis, periodic elections to the Verkhovna Rada and presidential elections, «orange» square, the revolution of dignity, the military conflict with Russia.

Quantitative indicators of the system are due to a significant reduction in the birth rate, which determined the acceleration of the annual population decline in all age groups. The COVID-19 pandemic, which continues in 2021, has contributed to population decline. In 2020, the number of deaths in Ukraine increased compared to 2019 by 35.7 thousand people.

However, in 2002–2008, the birth rate in Ukraine increased, which led to an increase in the number of high school students (ZNZ) from 2015 to 2020. According to the author's forecast, their number will begin to decline from 2021 and will reach 3,554,000 students in 2026, which are 650,000 fewer students than in the pre-war 2013.

A significant reduction in the number of CEE students in 2026 can not but affect the number of these educational institutions. Even with the current average school capacity of 272 students in 2019, 13,000 schools will be needed per school, with 15.2 thousand in 2019. Obviously, the structure of school reductions should depend on the number of students in the region, city, village, and topography. placement and, of course, the quality of teaching staff.

As for universities, academies, institutes, starting from 2019, there will be an increase in the contingent of freelance students in Ukraine. This is in line with existing evidence on the number of births since 2002. It is at this time, according to the State Statistics Service, there is a gradual increase in their number. If there are no cardinal changes in the socio-economic situation in Ukraine, the contingent of freelance students will tend to increase in the coming years (approximately until 2026), after which there will be a significant reduction in the contingent.

The declining trend in the birth rate, which has been observed since 2014, will have an impact not only on the contingent of freelance students, but also on other quantitative indicators of higher education in Ukraine, including: the number of freelancers the size of the scholarship fund and the salary fund of the staff of the HEI, etc. That is, forecasting the dynamics of quantitative indicators of the education system of Ukraine forms the basis for building a strategy for its development, but only taking into account the needs of the labor market, this strategy can be really useful for the country.

The analysis of the labor market of the eastern regions of Ukraine allowed to establish some tendencies of changes in its characteristics. These changes are due to both the transformation of the country's socio-economic system and the COVID-19 pandemic.

Almost unchanged leader in the number of vacancies from 2017 to the present is the group of specialties «Entrepreneurship, Trade and Exchange Activities» and «Management». The share of vacancies in these specialties reaches almost 50 %. Their leadership, according to the author, is due: firstly, the rapid growth of services in the country in contrast to the manufacturing sector, and secondly, a wide range of positions that can hold professionals in these specialties. Moreover, sometimes it is extremely difficult to determine the priority of each of them in relation to a particular position, because the required personal and professional competencies are similar in content. The 2020–2021 pandemic did not affect the share of vacancies in these specialties.

However, these specialties are not properly assessed by entrants and their parents, both in eastern Ukraine and in the country as a whole. The share of applications for these specialties is much lower than the share of vacancies.

As expected, invariably firm positions in the labor market are occupied by specialties under the general name «information technology», these include specialties: «computer science», «managing information systems and technologies», «cybersecurity», «software engineering». The share of vacancies in these specialties reaches 11 %. However, these specialties are significantly overestimated by entrants, both in the east and in Ukraine as a whole. Moreover, there is a significant increase in the share of applications for these specialties during the pandemic, due to the peculiarities of the work of specialists in these specialties (the ability to work remotely). In 2021, the requirements of employers for job applicants with 3 or more years of work experience have significantly decreased in these specialties. Such changes are also characteristic of the group of specialties «marketing, advertising and PR, media communications».

In general, studies have shown the possibility of quantifying the dynamics of both the labor market and the popularity of specialties among applicants. This analysis allows employers and university management to reasonably adjust their own marketing strategy to attract the most talented young people to relevant specialties. On the other hand, such an analysis allows applicants to make informed decisions about the choice of specialties.

One of the fundamental problems of the higher education system is the selection of entrants who not only have the necessary and sufficient abilities to master and use a certain range of knowledge, but also the necessary qualities for successful work after graduation.

The introduction in Ukraine of a system of enrollment in free economic education according to the scores of external independent evaluation of learning outcomes and the distribution of the state order between HEIs on the basis of national competition allowed: to eliminate suspicions of biased entrance exams; to restore children's faith in justice, to adjust them to the development of their lives by their own work, and not to find ways to obtain inflated grades; to form in parents the desire to provide children with quality education, rather than overestimation; significantly reduce the impact of administrative intervention in the process of assessing students' knowledge.

However, the introduction of a new system of enrollment in the HEI and the system of distribution of public procurement between them did not provide the expected increase in the quality of education. This is evidenced by the results of assessing the level of secondary education in Ukraine by international institutions, and the reduction over the past ten years of average scores of external examination certificates in mathematics and Ukrainian language and literature by 7–8 %.

Focus on successful test tasks has a significant side effect. The fact is that the successful completion of testing does not indicate a systematic mastery of the entrant of this particular subject, but demonstrates the formation of a certain database. Thus, it does not develop the ability to use the learned material to solve practical problems, not to mention the ability to synthesize new knowledge. This is not the fault of the applicants, as no one has set them a task or taught them to solve practical problems, let alone synthesize new knowledge. They were given the task to learn to perform test tasks within the EIT, and motivated and able students learned it.

In-depth study of any subject requires students not only a good memory, but also the ability to think systematically. This ability is based on the relevant abilities of a particular individual and is formed and improved in the learning process.

However, the system of education, which is aimed only at the successful completion of the EIT, does not help to improve the ability to think systematically, and at best leaves it at the same level that the individual inherited. Therefore, the monograph proposes an approach that will launch a mechanism of self-organization that will direct the most able students to the systematic mastery of certain disciplines, and not only to successful testing within the EIT.

With regard to the selection of entrants to study at universities, the author believes that two interrelated but not identical components of the integral characteristics of personality should be considered. It is easy to distinguish the first of them as academic or cognitive abilities that allow to effectively acquire knowledge. Then the second component characterizes the ability of an individual to creatively use this knowledge in practice and achieve success in life.

The first component of each personality is described by its cognitive-intellectual portrait, while the second – emotional-intellectual portrait.

The practice of evaluating the components of the first portrait of the individual has a long history and established methods. The monograph uses the method of determining the structure of intelligence of R. Amthauer and the method of creativity of E. Torrens. In addition, to assess the cognitive and intellectual abilities of entrants used the «competitive score» of the entrant, which was calculated on the basis of the scores of its EIT certificates.

Calculations have shown that all components of the cognitive-intellectual portrait to some extent affect the learning outcomes of the student at the university. However, the most indicative is the «competitive score» of the entrant. Its size when entering the university reliably predicts the level of success of a particular entrant in the learning process. Thus, the inclusion of the «competition score» as a component of the cognitive-intellectual portrait of the student is justified.

Emotional-intellectual portrait of the entrant includes the following components: Emotional awareness (self-awareness), management of their emotions (emotional self-regulation), self-motivation, empathy, recognition of other people's emotions.

A comparison of these portraits of freshmen at the university shows that against the background of high potential cognitive characteristics, students have insufficient development of self-motivation and management of their emotions. This shortcoming can hinder the successful mastery of specialties.

Fortunately, the components of emotional intelligence can be improved in the process of learning and practice. That is why it is possible to have a significant impact on the future success of university graduates through the formation of high indicators of EI components in the learning process.

The monograph shows that for four years of study on the integrated indicator EI the number of university students with a «critically low» level decreased from 13.4 % to 7.5 %. While the number of students with a «high» level increased from 4.6 % to 10.8 %. Such changes indicate a positive impact of university studies on the level of EI students.

However, we must state the practical absence of the influence of student life on the two components of EI: «managing their emotions» and «self-motivation». The percentage of students with the appropriate levels of these components remained virtually unchanged, which indicates a lack of equipment of the educational process with psychological methods of forming the relevant components of emotional intelligence.

The components «emotional awareness», «empathy», «recognition of other people's emotions» show a significant reduction in the percentage of students with levels of «critically low» and «low» against the background of a significant increase in the percentage of students with a level of «high».

In general, it should be noted that one of the main tasks of the university is to help its students form such an emotional and intellectual portrait that will ensure their successful future. Only the development of emotional intelligence on the basis of significant cognitive potential can ensure a successful career!

Problems of development of the education system of Ukraine are largely due to the lack of a clear system of its financing. Separate, inconsistent, unrelated legislative and executive decisions lead to an imbalance in the system.

In Ukraine, the expenditure on education as a share of GDP is quite high compared to other developed countries, but in absolute terms their size is certainly insufficient.

As a preliminary conclusion, it can be stated that the problem of higher education development in Ukraine is not only insufficient funding, its structure and dispersion of public procurement, but also insufficient management efficiency of both the HEI and the industry as a whole.

Universities are financed from the general and special budget funds. However, the ratio of expenditures from these funds for different universities are significantly different. For example, the ratio of expenditures from the special fund to general expenditures differs in different universities by an average of 41.9 % (from 18 % to 70 %). If we take into account that the special fund is formed by the university itself, then these figures are interpreted as follows. In Ukraine, there are

universities that are 70 % self-funded and universities that are only 17 % funded in this way and 83 % funded by the state.

In such conditions, it is not easy to develop an optimal financing system for this industry.

However, it is definitely necessary to support as economically as possible individuals who agree to pay the cost of training to ensure future career growth in prestigious or interesting for them specialties, business entities seeking to obtain highly qualified professionals, local governments, aimed at providing effective management at the local level through the involvement of qualified management specialists.

In order to help entrants pay for tuition, the Government adopted Resolution of the Cabinet of Ministers of Ukraine No. 916 of June 16, 2003 «Procedure for granting targeted preferential state loans for higher education». Each year a certain amount is allocated for such loans. This Resolution to some extent stimulates the filling of the special fund of the Budget. However, as is often the case, a great idea is discredited by the implementation mechanism. The monograph proposes measures to improve this mechanism.

Investing in higher education should be profitable for businesses of any form of ownership – this is the real experience of many developed countries. If the state is interested in co-financing higher education with business, then it is necessary to create objective motives for this. Such motives may be tax or organizational leverage.

The filling of the special fund significantly depends on the orders of business entities for educational services and for the implementation of research and development. However, in our state such activity is almost not supported economically. The monograph proposes changes to the current rules of the TCU in order to economically encourage these investments.

A weak link in the system of financing higher education is the formation of prices for educational services by each specific university. There is dumping, which leads to the discrediting of domestic higher education due to the extremely low quality of graduates. Because it is impossible to train a quality specialist without a sufficient level of funding.

At first glance, this problem is solved by the adoption of Resolution No. 191 of March 3, 2020. «Some issues of the introduction of indicative cost». However, the adopted Resolution does not eliminate the possibility of setting a dumping price, but only narrows the range of universities that have the opportunity to do so. The monograph offers a solution.

The inconsistency of laws and regulations leads to such paradoxes when the actual cost of the university for the service significantly exceeds the norm, which directly forces management to violate the law to provide quality service to the student. This situation has developed with the payment of a student for his/her bed in a dormitory. The monograph proposes a solution to this inconsistency of current regulations.

The approach to financing HEIs from the general fund of the Budget, introduced in 2020, is based on a mathematical model, the main parameters of which are given in the Cabinet of Ministers of December 24, 2019 No. 1146 «On the distribution of state budget expenditures between higher education institutions educational, scientific and international activities».

The basis of this approach is the idea of basic funding through the distribution of funds allocated in the budget for the relevant programs between the HEIs. Thus, they do not calculate the cost of training specialists, but redistribute the funds that have already been allocated. Thus, the issue of adequacy of funds to ensure quality training of specialists with higher education is not even considered.

In the monograph, based on the analysis of the set of indices and indicators used in the Resolution of the Cabinet of Ministers of Ukraine No. 1146, a reasonable conclusion is made about the urgent need for its completion. The formulaic approach, which was declared in the process of preparation of this normative act, remains only a fashionable motto, as it is not based on economic calculations and does not direct the management of HEIs to increase the efficiency of educational institutions.

It is necessary to revise the normative values of indicators for evaluating the performance of universities and introduce an additional indicator «Popularity of the HEI». In addition, if we do not change the structure of indices with the introduction of the index of state support for specialties necessary for the strategic development of the state, this resolution will not give the expected effect. In fact, its operation during 2020 confirms this thesis.

Moreover, it should be emphasized that the Resolution of the Cabinet of Ministers of December 24, 2019 No. 1146 alone will not solve the problem of financing higher education. Even if reasonable indices and indicators are adopted because:

– the infrastructure of the HEI, which does not currently meet the needs of a certain HEI and which is not directly related to the educational process, will be ignored, and its use to fill a special fund (commercial lease or alienation) is currently almost impossible. Legislation needs to be changed;

– outdated material base of laboratories cannot be updated due to the phenomenal dispersion of state orders for specialties that require modern equipment. Specialization is needed, which can be provided by public procurement management (failure to provide a state order for HEIs in a certain specialty, if the previous two years it did not provide a set of at least an academic group on a budget+contract). Concentration of training of specialists in such specialties in three or four HEIs will give an opportunity to update the material base at the expense of joint financing from the general and special funds.

In general, the analysis of the funding system and the proposals formulated in the monograph are aimed at improving the efficiency of the higher education system of Ukraine.

# REFERENCES


1. Kuznets, S. (1971). Modern economic growth: findings and reflections. Available at: https://www.nobelprize.org/prizes/economic-sciences/1971/kuznets/lecture/
2. State Statistics Service of Ukraine. Available at: http://www.ukrstat.gov.ua/
3. Shaban, O. Faktory zmenshennia kilkosti naselennia Ukrainy. Available at: https://www.slideshare.net/ssuser0463b8/-52337074
4. Valovyi vnutrishniy produkt za 2020 rik. Available at: http://www.ukrstat.gov.ua/operativ/operativ2020/vvp/vvp_kv/vvp_kv_u/vvpf_kv2020u.xls
5. Official hrivnya exchange rates. National Bank of Ukraine. Available at: https://bank.gov.ua/ua/markets/exchangerate-chart?startDate=01.01.2020&endDate=31.12.2020
6. Ofitsiynyi kurs hryvni shchodo inozemnykh valiut (seredniy za period). Available at: https://bank.gov.ua/files/Exchange_r.xls
7. Zaklady vyshchoi osvity. State Statistics Service of Ukraine. Available at: http://www.ukrstat.gov.ua/operativ/operativ2005/osv_rik/osv_u/vuz_u.html
8. Zaklady zahalnoi serednoi osvity (za danymy Ministerstva osvity i nauky Ukrainy). State Statistics Service of Ukraine. Available at: https://ukrstat.org/uk/operativ/operativ2005/osv_rik/osv_u/znz_u.html
9. Naselennia. State Statistics Service of Ukraine. Available at: http://www.ukrstat.gov.ua/operativ/operativ2007/ds/nas_rik/nas_u/nas_rik_u.html
10. Total fertility rate. Available at: https://en.wikipedia.org/wiki/Total_fertility_rate
11. Doslidzhennia ta dialoh shchodo polityky u sferi mihratsiyi i hroshovykh perekaziv v Ukraini (2016). Kyiv, 116. Available at: http://iom.org.ua/sites/default/files/mom_migraciya_yak_chynnyk_rozvytku_v_ukrayini.pdf
12. Mihratsiya yak chynnyk rozvytku v Ukraini. Available at: http://iom.org.ua/sites/default/files/infographics_15-03-16_ukr_0.pdf
13. Vyshcha osvita v Ukraini u 2019 rotsi. Statystychna informatsiya (2020). Derzhavna sluzhba statystyky Ukrainy. Kyiv. Available at: http://www.ukrstat.gov.ua/operativ/operativ2020/osv/vush_osv/vush_osv_19.xls
14. Zaklady zahalnoi serednoi osvity (za danymy Ministerstva osvity i nauky Ukrainy). Available at: http://www.ukrstat.gov.ua/operativ/operativ2021/osv/osv_rik/zzso_90-20_u.xls
15. Natsionalni osvitni indykatory (rozrakhovani na osnovi danykh z informatsiyno-telekomunikatsiynoi systemy «Derzhavna informatsiyna systema osvity», yaka pratsiuie u eksperymentalno-doslidnomu rezhymi). Available at: http://iea.gov.ua/indicators/
16. Oliinyk, O., Lehan, I., Sergiienko, L., Kovalenko, L., Tarasova, T. (2020). Alternative methodology for assessment of youth competitiveness in the labor market of Ukraine. Management Science Letters, 10, 2159–2168. doi: https://doi.org/10.5267/j.msl.2020.3.021

17. Davlikanova, O., Hofstetter, H. (2020). The «Duales Studium» Adaptation as an Innovation in Ukrainian Tertiary Education: Management Aspects and Results. Marketing and Management of Innovations, 3, 208–221. doi: https://doi.org/10.21272/mmi.2020.3-15
18. Ponomarenko, V. S. (2020). Rozvytok vyshchoi osvity v Ukraini: aspekty menedzhmentu ta marketynhu. Kharkiv: Vyd-vo «Maidan», 530.
19. Hladchenko, M., Vossensteyn, H. (2019). Ukrainian students' choice of university and study programme: means–ends decoupling at the state level. Quality in Higher Education, 25 (2), 133–154. doi: https://doi.org/10.1080/13538322.2019.1634878
20. Analitychna ta statystychna informatsiya. Available at: https://kha.dcz.gov.ua/analitics/70
21. Goleman, D. (2006). Emotional Intelligence. New York: Bantam Books, 360.
22. Goleman, D. (2006). Working with Emotional Intelligence. New York: Bantam Dell, 400.
23. Ponomarenko, V. S., Poliakova, H. A., Hryhorieva, Yu. S. et. al.; Ponomarenko, V. S. (Ed.) (2018). Zbirnyk doslidzhen z aktualnykh pytan zabezpechennia yakosti osvity u KhNEU im. S. Kuznetsia (na osnovi opytuvan studentiv universytetu za 2017/2018 navchalnyi rik). Kharkiv: KhNEU im. S. Kuznetsia, 128.
24. Flynn, J. R., Shayer, M. (2018). IQ decline and Piaget: Does the rot start at the top? Intelligence, 66, 112–121. doi: https://doi.org/10.1016/j.intell.2017.11.010
25. Bratsberg, B., Rogeberg, O. (2018). Flynn effect and its reversal are both environmentally caused. Proceedings of the National Academy of Sciences, 115 (26), 6674–6678. doi: https://doi.org/10.1073/pnas.1718793115
26. Gunnesch-Luca, G., Iliescu, D. (2020). Time and generational changes in cognitive performance in Romania. Intelligence, 79, 101430. doi: https://doi.org/10.1016/j.intell.2020.101430
27. Platt, J. M., Keyes, K. M., McLaughlin, K. A., Kaufman, A. S. (2019). The Flynn effect for fluid IQ may not generalize to all ages or ability levels: A population-based study of 10,000 US adolescents. Intelligence, 77, 101385. doi: https://doi.org/10.1016/j.intell.2019.101385
28. Robson, D. (2019). Has humanity reached 'peak intelligence'? Available at: https://www.bbc.com/future/article/20190709-has-humanity-reached-peak-intelligence
29. Ponomarenko, V. S. (2012). Problemy pidhotovky kompetentnykh ekonomistiv ta menedzheriv v Ukraini. Kharkiv: VD «INZhEK», 328.
30. Proskura, S. L., Lytvynova, S. G., Kronda, O. P. (2020). Students academic achievement assessment in higher education institutions. Paper presented at the CEUR Workshop Proceedings, 2732, 734–745. Available at: http://ceur-ws.org/Vol-2732/20200734.pdf
31. Ponomarenko, V. S. (2013). Problemes de formation des economistes et managers competents en Ukraine. Kharkiv: ME «INGEK», 352. Available at: http://irbis-nbuv.gov.ua/cgi-bin/irbis_nbuv/cgiirbis_64.exe?Z21ID=&I21DBN=EC&P21DBN=EC&S21STN=1&S21REF=10&S21FMT=fullwebr&C21COM=S&S21CNR=20&S21P01=0&S21P02=0&S21P03=A=&S21COLORTERMS=1&S21STR=Ponomarenko%20V$

32. Ponomarenko, V. (2021). Clusterization ofthe applicants'association affected by the mechanismsof self-realization of participants in the world educational process. Intellectual Potential of Society in the Context of Permanent Social Changes: Ways of Retaining and Development. Proceedings of the annual XIX international scientific and practical conference. Prospective students' environment under glocalization: ways of formation and the main trends. Kharkiv: People's Ukrainian Academy, 5–14. Available at: http://dspace.nua.kharkov.ua/jspui/bitstream/123456789/2134/1/%d0%9c%d0%b0%d1%82%d0%b5%d1%80%d0%b8%d0%b0%d0%bb%d1%8b%20%d0%ba%d0%be%d0%bd%d1%84%d0%b5%d1%80%d0%b5%d0%bd%d1%86%d0%b8%d0%b8%2012.02.2021.pdf
33. Unified state electronic database on education. Available at: https://registry.edbo.gov.ua/opendata/entrant/
34. Prokopenko, I. F., Melnykova, O. V. (2017). The higher education as the factor of Ukrainian economic growth: the modern state and prospects of development. Zbirnyk naukovykh prats Kharkivskoho natsionalnoho pedahohichnoho universytetu imeni H. S. Skovorody. Ekonomika, 17, 5–14. Available at: http://journals.hnpu.edu.ua/index.php/economics/article/view/252
35. Iosif, A. E. (2014). Assessing the impact of innovation on national competitiveness in the European Union. Proceedings of The 24th Annual RESER Conference – Services and new societal challenges: innovation and sustainable growth and welfare. Helsinki, 633–640.
36. Usyk, V. (2019). Peculiarities of the Higher Education Funding: Analysis of Ukrainian and World Contex. Bulletin of Taras Shevchenko National University of Kyiv. Economics, 2 (203), 59–67. doi: https://doi.org/10.17721/1728-2667.2019/203-2/8
37. Petrakov, Y. (2017). Higher education funding models in Europe and the world. Finance of Ukraine, 12, 95–121. Available at: http://nbuv.gov.ua/UJRN/Fu_2017_12_9
38. Bogolib, T. M. (2017). Financing higher education in Ukraine: problems and prospects of their solution. American scientific Journal, 9, 70–78. Available at: https://www.elibrary.ru/item.asp?id=29010086
39. Kovalenko, Yu. M., Vitrenko, L. O. (2020). Financing of higher education institutions in Ukraine. Irpin: University of the SFS of Ukraine, 238. Available at: http://ir.nusta.edu.ua/jspui/handle/123456789/5637?locale=uk
40. Gryshchenko, I. M., Tarasenko, I. O., Tsymbalenko, N. V., Nefedova, T. M., Tarasenko, O. S. (2019). Model of investments optimization in improving economic potential of university. Espacios, 40 (36). Available at: https://er.knutd.edu.ua/bitstream/123456789/14751/1/20191219_301.pdf
41. Matyukhina, N., Borysenko, I., Malakhova, A., Sikun, A. (2020). Financial and legal ensures effective development for higher education in Ukraine. Financial and Credit Activity: Problems of Theory and Practice, 1 (32), 482–493. doi: https://doi.org/10.18371/fcaptp.v1i32.200757

42. Pro rozpodil vydatkiv derzhavnoho biudzhetu mizh zakladamy vyshchoi osvity na osnovi pokaznykiv yikh osvitnoi, naukovoi ta mizhnarodnoi diyalnosti. Postanova Kabinetu Ministriv vid 24 hrudnia 2019 roku No. 1146. Available at: https://zakon.rada.gov.ua/laws/show/1146-2019-%D0%BF?lang=ru#Text
43. Pro zatverdzhennia normatyviv chyselnosti studentiv (kursantiv), aspirantiv (adiunktiv), doktorantiv, zdobuvachiv naukovoho stupenia kandydata nauk, slukhachiv, interniv, klinichnykh ordynatoriv na odnu shtatnu posadu naukovo-pedahohichnoho pratsivnyka u vyshchykh navchalnykh zakladakh III i IV rivnia akredytatsiyi ta vyshchykh navchalnykh zakladakh pisliadyplomnoi osvity derzhavnoi formy vlasnosti. Postanova Kabinetu Ministriv Ukrainy vid 17 serpnia 2002 roku No. 1134. Available at: https://zakon.rada.gov.ua/laws/show/1134-2002-%D0%BF#Text

Volodymyr Ponomarenko

SOME PROBLEMS OF THE EDUCATION SYSTEM IN UKRAINE: ANALYTICS

Monograph

Technical editor I. Prudius
Desktop publishing T. Serhiienko

PC TECHNOLOGY CENTER
Published in October 2021
Enlisting the subject of publishing No. 4452 – 10.12.2012
Address: Shatylova dacha str., 4, Kharkiv, Ukraine, 61165