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**IDENTIFYING TRENDS IN THE DEVELOPMENT OF HIGHER EDUCATION OF UKRAINE BY VISUAL ANALYTICS**

The article analyzes the development trends of higher education institutions of Ukraine, scientific priorities of profile specialties and the principles and criteria of their rating by specialty are substantiated. Taking into account the changes in the economy in the direction of digitalization, a retrospective analysis of the labor market was conducted. The priorities of entrants in choosing modern specialties are outlined.

As part of the study was found, that the number of institutions of higher education, operating on the territory of Ukraine, as well as the number of students, who learn from them, dynamically decreasing. At the same time, there is a decrease in the use of public funds, with a simultaneous increase in the use of funds of individuals and local budgets. The work is noted, that number of students, who will receive education at all levels, significantly decreases. Moreover, there is a quantitative advantage of men in obtaining preschool, primary, secondary and post-secondary non-higher education, as well as a short cycle of higher education. However, at the level of bachelor's, master's and doctoral programs, a significant quantitative advantage of women has been revealed, which has recently tended to decrease, especially at the doctoral level.

Information flow of registered entrants of the unified state electronic database of education for 2018-2020. developed by Microsoft Power BI big data processing software, which made it possible to quickly and efficiently obtain analytical data from the submission of documents to the enrollment order.

Thus, according to research in Ukraine, specialties have been identified, which border on information technology and are in demand in the labor market. It should also be added, that there are directions in the study, which should be reviewed and upgraded, or combined to improve their effectiveness.

It also became obvious that the quality of higher education services provided primarily meets the requirements of the modern information market, especially during the pandemic.

Educational programs, which provide for dual forms of learning, carry out its internal evaluation, that is, provide a set of measures and procedures, which guarantee the quality of the offered educational services that meet modern market criteria.

**Keywords:** higher education in Ukraine, visual analytics, Power BI, education analytics, ranking of specialties, labor market

Fig. 7. Ref. 13.

**Introduction.** With the development of modern information technology, minimization and reduction of microcomputers, the need for relevant specialists has also increased immeasurably. As is well known, the labor market and educational institutions are linked by common areas of activity, introduction of new technologies and methods of their use. Particular attention is paid to such qualities of employees as professional mobility, ability to learn quickly and acquire new knowledge, think creatively and others.

A new stage in the development of human civilization significantly changes the idea of human formation, priorities of her personal qualities, life guidelines, values. Qualitatively new requirements are put forward to the education system, through which almost the entire younger generation comes to life [1].

Research company “Grand View Research” draws attention, that the growing proliferation of e-learning technologies, such as mobile learning devices, information systems for students, collection of lectures and learning management systems (LMS), allowed the education sector to have easy access to vast chunks of data on teaching and learning practices [2].

Company specialists Grand View Research identified and forecast, that the volume of the global education and training analytics market is estimated at 17,01 billion. US dollars in 2018 year, and expected, that it will grow with compound annual growth rates (CAGR) 17,4% with 2019 on 2025 year. [2]

Research analysts point to that, that methods, models that are studied and researched in educational institutions, and later used to increase the productivity of professional abilities of students. Such specialists are in demand in the labor market as much as entrepreneurial activity converts the acquired knowledge to optimize and increase its capacity. The use of methods, algorithms in the enterprise sector is growing as a way to strategically set goals and track the performance of employees in various organizations [2].

It is well known, that any research is enshrined in practice, which is sometimes difficult to create in the laboratory, so the introduction of existing conditions is nothing more than fulfilling the role of education in the new system of social relations: a socially oriented market economy.

The versatility of scientific methods, algorithms, the study of new technologies is a complex body consisting of a huge number of different production, commercial, financial, information and educational structures. Modern technologies allow to process large data sets, which has a positive effect on the interaction within the business law network and are united under the general concept of "market". In modern social and economic conditions, vocational education has become one of the key social institutions and has formed a rather complex structure.

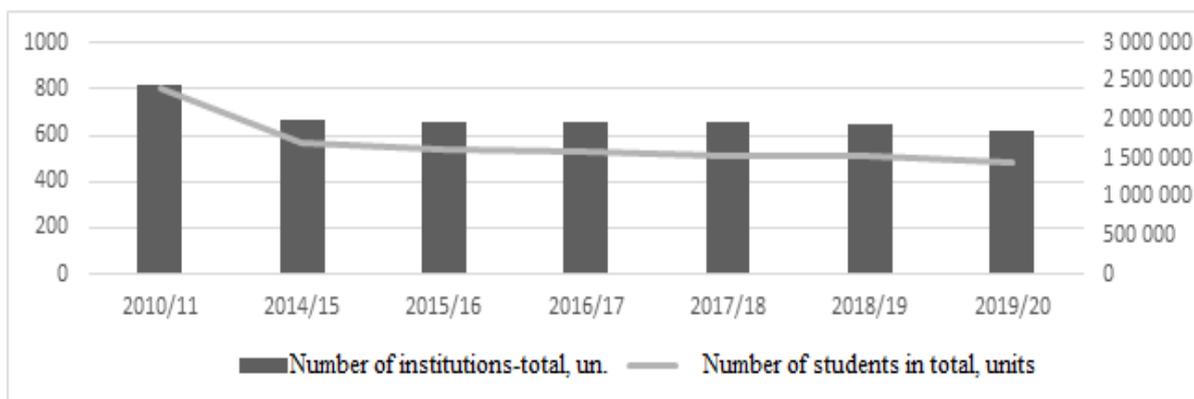
The category "vocational education" means as a system of institutions, providing educational services and the actual acquisition of a profession with certification in addition to the forms, process and technologies of training. The complexity of this category is also determined by the fact that it covers a variety of human activities, including collective social

work, which becomes even more complex and consumer due to advances in science and technology [3]

The professional qualification of a specialist has become decisive for quality goods and modern services. That is why a high level of vocational education is a major factor in the country's economic incentives and competitiveness around the world, but economic criteria are not the only indicator of vocational education performance. This is an important factor in social and personal development, forming active attitudes of both social groups and individuals; in other words, it is a means of self-actualization of both social groups and individuals.

The social and personal significance of vocational education (as well as its functions in society) is determined culturally and historically, which requires constant study and conceptualization to bring it into line with the pedagogical system, especially at critical stages of social development. In times of changing economic environment and new forms of production, where there is a significant abundance of labor, vocational education is becoming an important way to reduce social tensions.

The modern system of higher education operates on the basis of fierce competition. The conditions for the formation of demand for educational services of higher education institutions are influenced by many factors, and one of the main is the contingent of applicants. In recent years, Ukraine has seen a negative trend in the number of applicants, due to both objective reasons, including the deteriorating demographic situation in the country, and subjective - the decline in attractiveness of higher education due to difficulties in further employment of graduates and the transformation of the modern labor market. digitalization processes. Fig.1 demonstrates a dynamic decrease in both the number of higher education institutions operating in Ukraine and the number of students studying there. The relevance and social significance of the analysis and consideration of the number of potential entrants to higher education institutions, as well as their applicants for higher education, requires special attention, as it is a priority for reforming the higher education system in a country affected by the demographic crisis global financial and economic crisis and the pandemic situation.



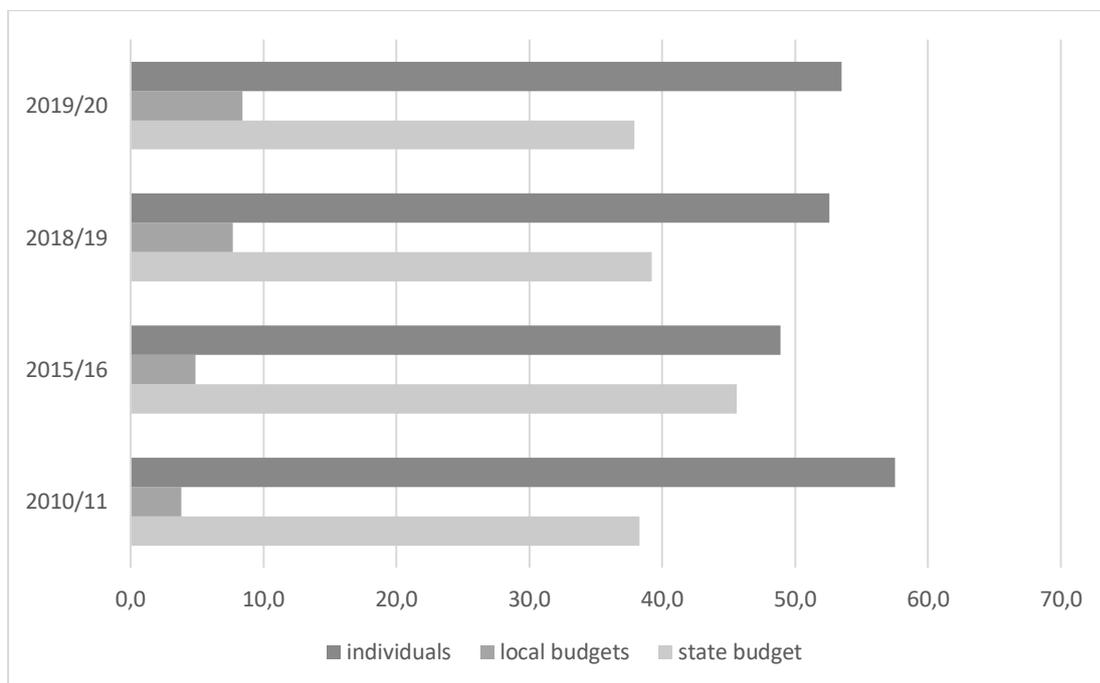
**Fig. 1 - Number of higher education institutions and students**

*Author's development on the basis of [4]*

Carrying out a retrospective analysis of the higher education sector, it can be noted that since 1991, the market of educational services in Ukraine has developed intensively and dynamically. The network of higher education institutions expanded from 149 institutions in 1991 to 353 institutions in 2008, which marked the peak of the extensive expansion of the market for educational services. Thus, in 18 years the number of higher education institutions has increased 2.37 times. At the same time during this period there was an increase in the

number of students by 2.38 times, ie from 881.3 thousand people. in 1990 to 2364.5 thousand people. in 2008. The largest number of students was in the period 2006-2009. However, in the 2008-2009 academic year there was a turning point, which can be characterized by the following trends: a decrease in the number of universities, the number of applicants and graduation. The objective reasons for this are primarily the demographic decline of the early 90s of the twentieth century and public awareness that education must meet the requirements of the modern labor market. The current state, as shown in Figure 1, continues to show a steady downward trend in both the number of higher education institutions and students enrolled in them.

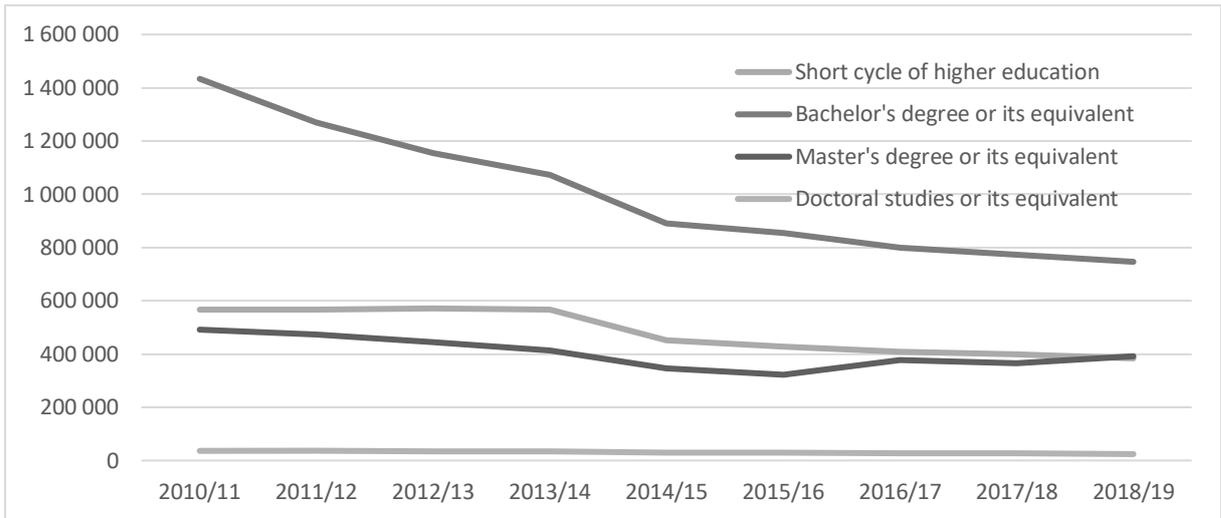
Analysis of the share of students studying at the expense of different types of funds shows a steady trend to reduce the use of public funds, while increasing the use of funds of individuals and local budgets (Fig. 2). A significant reduction in public procurement for higher education seekers further reduces the attractiveness of higher education for the modern entrant.



**Fig. 2 - The share of students (%) who study at the expense of individuals, local budgets and the state budget**

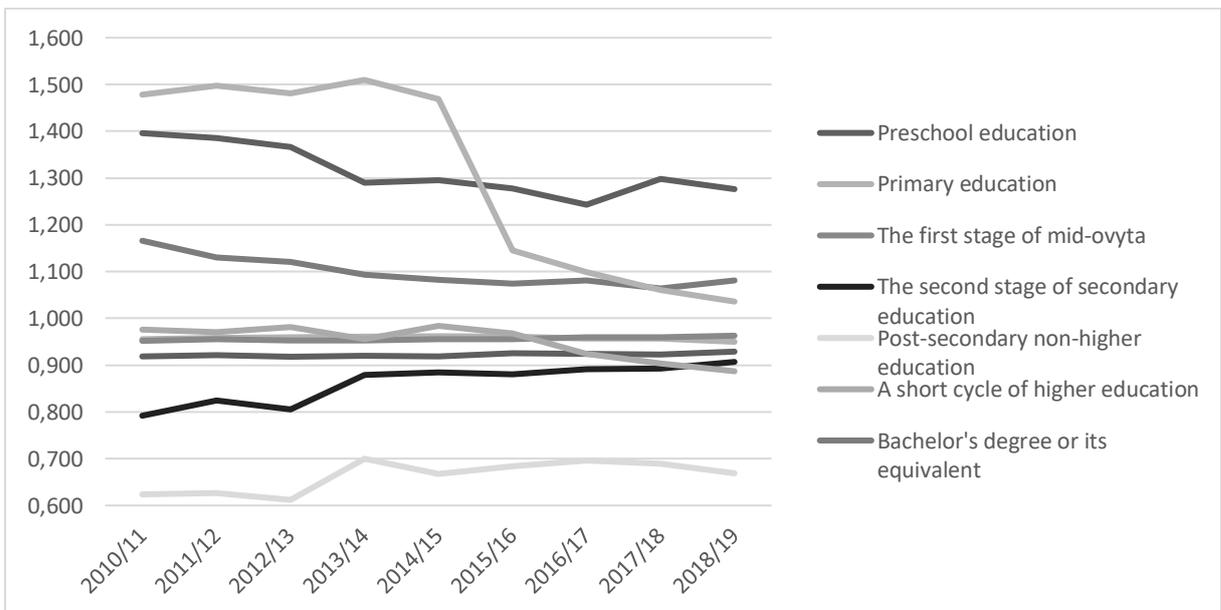
*Author's development on the basis of [4]*

The distribution of the number of applicants for higher education in Ukraine according to the International Standard Classification of Education ISCED 2011 (Fig. 3) shows a decrease in the number of students who will receive education at all levels. Most of all, the declining trend has affected the bachelor's degree, in which the decline in the number of entrants is the fastest. Only in the last four years there has been a gradual increase in the number of entrants, which, unfortunately, has not yet reached the level of 2011.



**Fig. 3 - Distribution of the number of students of educational institutions of Ukraine according to the International Standard Classification of Education ISCED 2011.**  
 Author's development on the basis of [4]

The gender distribution of participants in the educational process is noteworthy. Thus, the indices of gender parity among pupils, students and students of educational institutions of Ukraine, which are calculated as the ratio of the number of females to the number of males according to UNESCO (Fig. 2), emphasize the quantitative advantage of men at the initial stage of education. , secondary and post-secondary non-higher education, as well as a short cycle of higher education). However, at the bachelor's, master's and doctoral levels, there is a significant quantitative predominance of women, which has recently been declining, especially at the doctoral level.



**Fig. 4 - Indices of gender parity among pupils, students and students of educational institutions of Ukraine**  
 Author's development on the basis of [4]

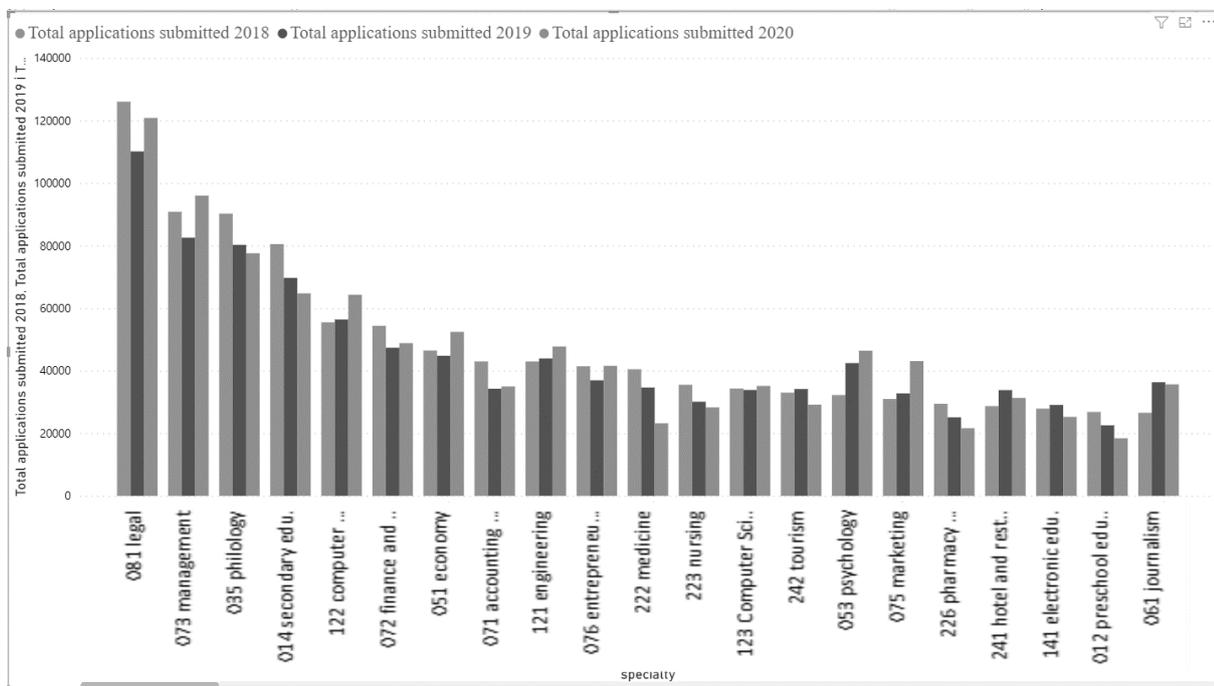
Does not add attractiveness to modern education and the rapid trend to change the top areas of study. Specialties that were in trend yesterday may not only cease to be in demand in the dynamically renewed labor market, but may also disappear or transform into others. Given the period of education at the bachelor's level - 4 years, and at the master's level - 5 years, these risks are becoming increasingly relevant and threatening.

In order to further study the specialties in demand, we turned to the "Unified State Electronic Database on Education" [7] and received a database containing more than four million records.

The database was processed by means of MS Power BI, which allowed to quickly and efficiently obtain analytical data shown in Fig.5. Thus, according to research in Ukraine, the most popular are specialties of economic and legal nature, which are practically based on modern network computer technologies. Accordingly, the theory of adapting vocational education to the new realities of the market is confirmed.

To process statistical data and give the appearance of visual analytics for ease of perception, we have built a Dash-board using Ms Power BI in which information is transformed into a graphical dynamic representation. The results of data processing were combined into relevant tables of facts and dimensions, which were summarized and grouped.

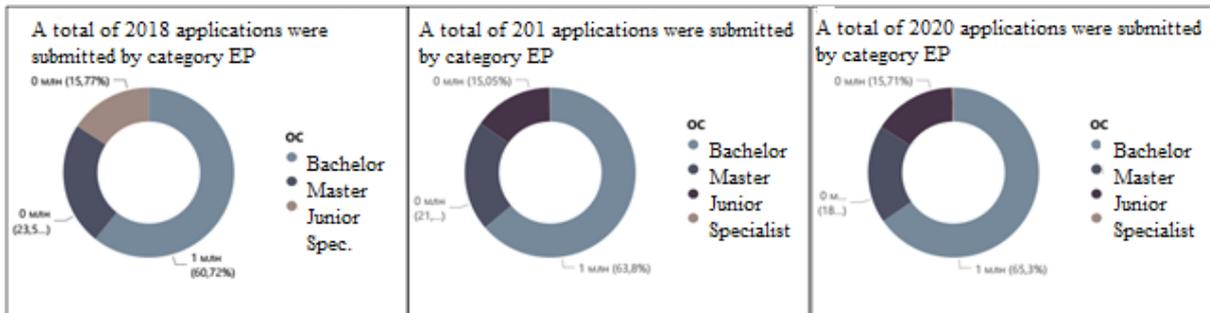
Based on the processed data, it is determined that in the organization of education, work, students are actively mastering specialties that use information technology in their activities. The spheres of the market in which the acquired theoretical and practical skills of students find implementation and creative approach were analyzed. Thus, the expectations of entrants for the future profession and learning outcomes described graphically are shown in Figure 5 and Figure 6, that the quality of higher education services meet primarily the requirements of the modern information market, especially during the pandemic.



**Fig.5 - Number of submitted applications (persons) for admission to universities of Ukraine in specialties for 2018-2020**

Author's development on the basis of [7]

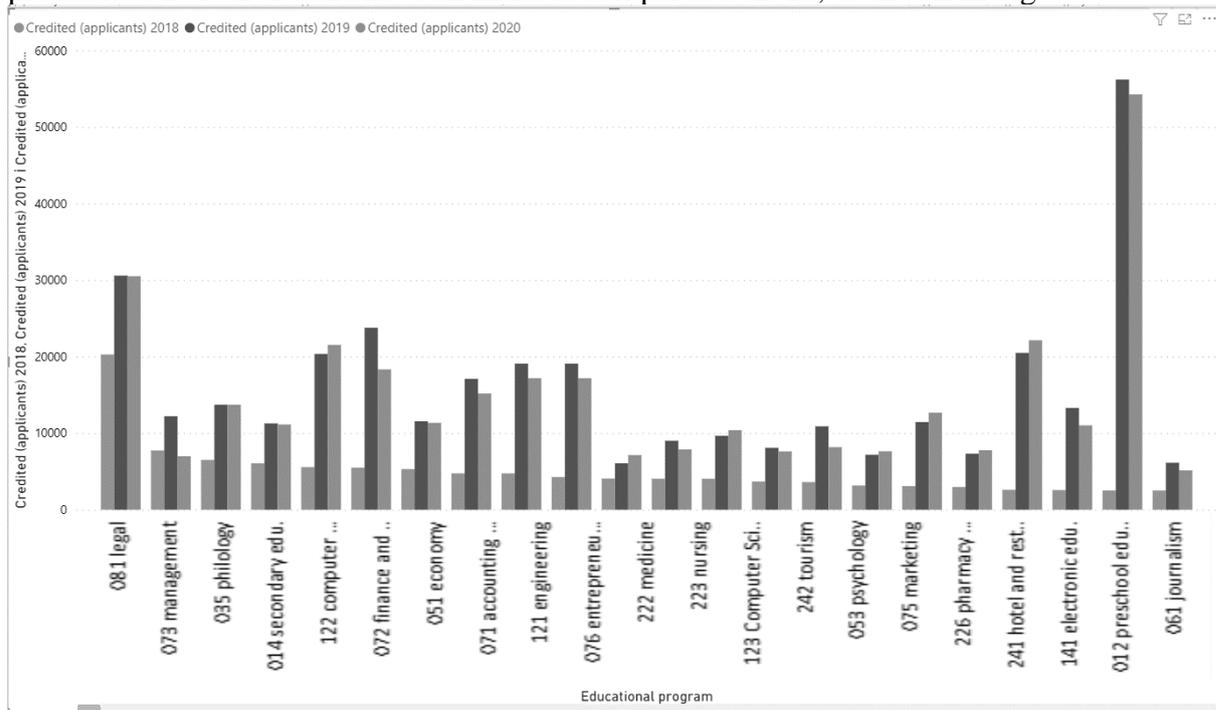
With the emergence of new market needs, the master's level and mastery of educational programs of professional junior bachelor remain stable, which is confirmed by comparing the data in Fig.6. for 2018-2020.



**Fig.6 - Proportion of applications submitted to Ukrainian universities for education levels of 2018-2020**

Author's development on the basis of [7]

The results of the introductory campaign maintain a stable trend in the ranking of popular professions 2019-2020 and have an increase compared to 2018, as shown in Fig. 7.



**Fig.7 - Rating of specialties according to the indicator of enrolled persons in universities of Ukraine for 2018-2020**

Author's development on the basis of [7]

**Conclusions.** The general conclusion of the study is that in today's conditions due to the introduction of artificial intelligence, the active use of modern technologies in all sectors of the economy, much of the labor market or refocused on high-tech professions, or gradually took the vector to destroy many areas. which train specialists in modern higher education institutions. This problem is especially relevant at the bachelor's level, where for four years of study

traditional areas of training become obsolete and transform into innovative ones. That is why the demand for undergraduate admission is low. Moreover, the tendency to reduce the number of entrants to bachelor's programs is becoming more and more relevant, as it affects not only the reduction of higher education students, but also the reduction in the number of higher education institutions that prepare them.

The solution to this problem should be the change of traditional educational programs in the direction of digitalization with the active introduction of disciplines in the educational process with the use of modern technologies at all levels: user, programmer, data scientist, designer and web designer, big data specialist. The main components of STEM education should be included in all existing educational programs to ensure longer retention in the labor market. Also one of the relevant components for educational programs in any field should be Soft Skills to gain teamwork skills, a high degree of creativity, flexibility, self-management skills and the ability to learn throughout life. Because today the modern labor market needs not narrow specialists, but well-known specialists who will be able to work on a computer, search and find up-to-date information, analyze data, present them to the team and make optimal management decisions at their level. The Department of Economic and Management Analytics of Donetsk National University from 2020-2021 academic year has developed and implemented a modern educational program Business Economics, which provides applicants with three popular professions that will be relevant in the future: manager, economist (economics), analyst (data scientist) [13]. Graduates of the Business Economics educational program are universal specialists in the modern labor market in the field of economics and business environment. They believe that the large amount of data provided by the modern digital economy is a huge advantage of a competent manager and they successfully use it to obtain information at every step of decision making: customer analytics, product analytics, HR analytics, marketing analytics, visual analytics, systems decision making, risk management. And this is just the tip of the iceberg, which provides analytical skills to the graduate of Business Economics. Because through the acquisition of competencies at three levels: management, business economics and analysts, they are focused on making optimal management decisions at the level of analysis of the enterprise to improve its efficiency, optimize financial flows, develop quality marketing strategy, work effectively with staff. They know how to work in a team and masterfully manage it.

Thus, the opening of new competitive educational programs will allow to maintain the desired position of educational programs in the modern, incredibly dynamic labor market, and should be one of the important factors influencing the negative dynamics of higher education and reducing the number of both entrants and higher education institutions. As a result, it should help raise the profile of Ukrainian higher education in the world and attract foreign applicants, which is an extremely important issue in a pandemic, at a time when Ukrainian higher education institutions have almost left foreign students.

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