

# Contemporary Management of University's Strategic Development: the Case Study on Ukrainian Universities

Olena Kovtun<sup>1</sup>, Vitalii Lutsiak<sup>1</sup>, Anatolii Ostapchuk<sup>1</sup>, Daria Lavinska<sup>1</sup>, Kseniia Sieriebriak<sup>2</sup>, Anna Kononenko<sup>3</sup>, Svitlana Bebko<sup>3</sup>

[O17208@ukr.net](mailto:O17208@ukr.net)

<sup>1</sup>National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine

<sup>2</sup>Volodymyr Dahl East Ukrainian National University, Severodonetsk, Ukraine

<sup>3</sup>Kyiv National University of Technologies and Design, Kyiv, Ukraine

## Summary

In the current conditions of world socio-economic development, the strategic support of the process of managing the development of universities has become a particularly important area. Strategic management requires reliable information and analytical support in the form of sound descriptions of strategic directions of development, assumptions, and forecasts. The purpose of the study is to substantiate and elaborate the crucial causes in the strategic management of university's development and to suggest the coherent prospects for advancements. The data analysis was performed using descriptive methods to identify the most significant causes that affect the university's strategic development; the expert assessment was used to rank the factors, ultimately to assess each factor that affects to some extent the university's strategic development; the abstract-logical method was used to ground the positive impact of computer technologies and e-learning on the strategic development of a university and to formulate proposals for its further progress. The main results provided in the given paper showed that significant and most important strategic cause of university's development lies in the field of improving the quality of education, expanding access to educational services based on computer technology and its functionality. In turn, its widespread use at all stages of the educational process allows providing a number of advancements for universities in strategic prospects.

**Key words:** *university, strategy, management, development, electronic learning technology*

## 1. Introduction

Overcoming the inefficiencies of education spending common to the education systems of many countries is vital to ensuring resource efficiency and strengthening the direct connection between education outlay and its effectiveness. The implementation of such complex strategic tasks is not possible without revising the development strategies of educational institutions and the transition to a new quality level of education. Over the past decade, public spending on education around the world has been steadily rising. However, the crisis surrounding the Covid-19 pandemic has severely affected the upward trend in education spending. According to the World Bank Group (World Bank Group,

n.d.), low-income countries are likely to reduce spending on education or move from a positive to a negative tendency after the Covid-19 pandemic. At the same time, responding to the crisis associated with the dissemination of Covid-19 requires additional outlay for the adaptation of educational institutions to the necessary measures to wrestle infection. Consequently, additional funds are necessary for financing programs to compensate training losses of educational institutions when they were closed and limited the provision of educational services.

The World Bank also emphasizes that education systems in many countries face significant challenges in the efficient use of finance. It is important to note that the increase in public spending on education before the Covid-19 pandemic went in line with a relatively small improvement in educational performance. The World Bank recommends various strategic decisions to given order (World Bank, 2019): development of appropriate political and technical solutions; ensuring effective teaching; providing unlimited access to more quality texts, taking into account the age and qualifications of students, etc. For this reason, providing support to address education matters at the country and educational institutions level is a crucial task for conducting appropriate measurements and undertaking relevant studies.

The UN Program 2030 includes the Sustainable Development Goals, the fourth of which is the goal of ensuring inclusive and equitable quality education and promoting lifelong learning opportunities. In the given context, education can be defined as a unique opportunity with the potential for change in life, based on the desire to overcome poverty and ensure environmental sustainability, supported by the desire for social justice, based on human rights instruments. It is important to note that quality inclusive education encompasses transformations in culture, policy, and practice to formal and non-formal learning environments, taking into account the different requirements and characteristics of individual students, and removes barriers to education. Here the focus is on ensuring effective participation, accessibility, attendance, and

achievements of all applicants (UNESCO, 2020). Another aspect of the educational process is that the high cost of educational decisions and their importance for the further life of applicants make education vulnerable to unscrupulous behavior of stakeholders. Violations of integrity are strategic by their nature and can take a variety of forms, from abuse of resources, assets, and authority to fraud and plagiarism. At the same time, national anti-corruption strategies to a greater extent contain measures aimed at visible and often criminal manifestations of dishonest behavior, while neglecting less visible but no less harmful forms of violations. This makes it necessary to form a strategy for the development of educational institutions from the point of view of sectoral forms of corruption in education or shortcomings in their educational policy (OECD, 2017).

It is common knowledge that a university's strategic management is focused on ensuring innovation and change in a management decisions process. The most important feature of the management decision is its direct focus on the organization of cooperative work. Hallmarks of strategic management decisions are the complex and little-known structure of the problem situation, the great importance of decisions, the long time horizon, and a high degree of inaccuracy. At the same time, strategic management decisions are the basis for developing development strategies and relate to the most important goals and activities. Also, strategic management decisions require the establishment of the mission and goal of the university in a particular area of activity, analysis of the external environment and internal state of the organization, evaluation of strategic alternatives, and strategy selection (Ansoff, 1965).

Nowadays, the strategy implementation process is considered to be a dynamic process. Thereupon, the effective implementation of the organization's strategy requires a set of specific actions being consistent both to each other and to the external environment. Traditionally, the implementation of the strategy means a process that includes gradual changes in organizational structure, organizational culture, leadership styles, skills and knowledge of employees, budgeting, etc. (Barney, 1991). Accordingly, the effectiveness of the strategy depends not so much on personal characteristics, but on knowledge and understanding of management tasks, ways to stimulate and unite the efforts of all members of the organization towards the goals of the organization (Galushko et al., 2018).

Additionally, a characteristic feature of education is its understanding as a "soft", fuzzy system. The Soft Systems Methodology (SSM) is based on two alternative paradigms that explain the nature and significance of system thinking. One paradigm considers reality as systemic and studies it systematically, and the other considers the world as problematic, perhaps systemic, but allows for many interpretations (and such reality is also studied

systematically). In any case, it is necessary to consider areas of activity, individual actions, and factors that in the strategic perspective are able to ensure the consistent development of the educational institution (Grant, 1991).

It is equally important that educational systems are social systems. They are more complex than mechanical or biological systems. Their complexity often makes it impossible to identify the core factors of success or the cause of failure. In such conditions, strategic planning requires adjusting and taking into account the uniqueness of each organization (Brockova et al., 2021; Gryshchenko et al., 2021; Lozhachevska et al., 2021; Mykhailichenko et al., 2021; Semenov et al., 2021; Zherdetska et al., 2021; Zoskior et al., 2020, 2021; Kyryliuk et al., 2021; Mayovets et al., 2021; Rossokha et al., 2021). With this in mind, Oehmichen et al., consider the influence of institutional investors on the uniqueness of an organization's strategy. The specific study is based on the paradox of uniqueness, according to which unique strategies are important economic drivers of development, but the leaders of organizations, due to pressure in the capital market, are reluctant to choose unique strategies. In order to solve this problem, it is proposed to attract special institutional investors (Oehmichen et al., 2021). Dedicated institutional investors are interested in obtaining unique information about their investments, make efforts to understand the strategies of organizations in which they invest, and reduce the pressure on the capital market. Thus, targeted institutional investments can encourage company executives to deepen and diversify their own strategies. Also, the results delivered by Oehmichen et al. (Oehmichen et al., 2021), prove the existence of a positive connection between the involvement of specialized institutional investors and the strategic uniqueness of organizations. It is crucial to emphasize that this connection is stronger when organizations operate in areas that are difficult to assess, including education.

Ensuring the order of research of strategies by historical data allows developing more substantiated causal theories on accomplishment (or impossibility of achievement) of such organizational results, as growth, survival, or steady competitive advantage. Argyres et al. (Argyres et al., 2020) emphasized that researching strategies based on sound history can be traced as organizations, groups and/or individuals, making decisions and acting in a specific historical context and interacting, achieve tangible organizational results, such as growth, survival and sustainable competitive advantage.

The study of Hmieleski & Powell reviewed new trends in technology commercialization and the important role that individual researchers may have to play in order to ensure greater success of universities' efforts to generate and use such activities (Hmieleski et al., 2018). As a result, the formation of policies and strategies for the development of universities should be carried out taking into account the

following trends: the growing need for more accurate and sophisticated theoretical justifications; the desire of scientists for potential methodological and empirical achievements; priority in the commercialization of technologies.

Agrawal (Agrawal, 2006) explored the practical aspects of applying new knowledge gained from research in universities. It is determined that strategies involving the inventor ensured the success of the organization and the commercialization of its products to a greater extent. In this case, Agrawal notes some crucial features of strategic management of the organization based on the involvement of the inventor for both natural and social sciences: organizations may underestimate the potential contribution of inventors; organizations may vary to the extent that they do not know what they do not know; organizations have different levels of experience, while those with more experience may be less likely to involve the inventor; some inventions may not require as many additional developments and modifications as others; licensed organizations may be reluctant to commercialize an invention for strategic reasons, even if they have incurred licensing costs. As a result, the inclusion of researchers and their activities, in addition to publications and presentations at conferences, can create valuable ideas with significant economic and social impact.

It is equally important that although innovative organizations are increasingly relying on academic studies they use only a subtle fraction of all scientific inventions. Bikard & Marx argue that hubs act as bridges between academic and corporate technology so that such centers direct academic research to corporate interests in two ways. First, centralized discoveries in academia are of better quality and more widely used. Secondly, organizations - in particular young, innovative, science-oriented - pay considerable attention to centralized discoveries. Not only the centers contribute to the localized flow of knowledge, but also expand the geographical range of academic science, attracting the attention of remote organizations (Bikard et al., 2020).

Studies were undertaken by Jae-Woong et al. (Jae-Woong et al., 2020). focused on the commercialization of technologies transferred by universities and state research institutes (U & PRI) to private enterprises. It had been found that the intensity of market competition significantly affected the successful commercialization of innovations, and successful commercialization in turn affected business growth. Consequently, an effective partnership is a key factor in the successful commercialization of transferred technologies, regardless of the market situation. After all the transfer of research from universities contributes to the short-term success and strategic growth of private enterprises in conditions when market competition is strong.

At the same time, an essential aspect of strategic management of educational institutions is the study of the

influence of geographical and organizational distance of direct interpersonal relationships established by the university researcher on the creation of knowledge. According to research was carried out by McFadyen & Cannella (McFadyen et al., 2005), there is a nonlinear relationship between distance and knowledge creation, as spatially close and distant places of exchange of partners will have a greater impact on knowledge creation than intermediate distances.

Fini et al., studied how the research of an academic scientist had been influenced by the simultaneous implementation of entrepreneurial activity. Thus, the authors revealed the idea that entrepreneurship was able to avert the attention of scientists from interdisciplinary research and shift their focus to generate new knowledge that is important for the further development of technology. Consequently, entrepreneurship leads to increased research efficiency through the implementation of intelligence. From a practical point of view, the commercial work of scientists can contribute to the development of basic science (Fini et al., 2021).

Foster et al. had been based on the analysis of scientific publications investigated what factors influenced the scientist's choice of a research problem, which significantly determined the strategic priorities of organizations (Foster et al., 2015). According to their findings, this choice was formed by "significant tension" between the professional desire for productivity and the desire for risky innovation. The distribution of strategies remained extremely stable, even as the development of industry knowledge accelerated sharply. Risky strategies that focused on knowledge gained through new opportunities were less common in the literature. The researches that had been based on risky strategies were more likely ignored but were also more likely to achieve significant impact and recognition. An interesting result of this study is that based on the identification of knowledge clusters using the map equation community detection algorithm (the map equation community detection algorithm) and considering five possible inventive strategies (jump, new consolidation, new bridge, repetitive consolidation, repeating bridge), the authors concluded that researchers chose certain elements of basic strategies for the formation of their research trajectory. Based on such results, it is possible to manage the strategic development of the organization, taking into account the effectiveness of combining different elements of basic strategies with the definition of priorities of their group of researchers.

Auer-Srnka & Koeszegi in response to a request from the scientific community for more discovery-oriented research, at the same time had proved the basic paradigm in business and management, which was the need for theoretical testing and statistically significant results in strategic management. In particular, in (Auer-Srnka et al., 2007). emphasized that integrated qualitative and

quantitative research could be used both for theoretical testing and to obtain new theoretical conclusions. Quantitative research methods allow researchers to draw statistical conclusions and obtain practical results (Buber et al., 2004). Qualitative research is traditionally used in the social sciences to form a complete, deep understanding of the opinions or attitudes of the target audience (Pryshliak et al., 2020). And are supplemented by quantitative studies in a sequential or parallel manner, which allows the application of two methodological approaches simultaneously. However, to significantly enrich the body of knowledge, good research requires cross-links between qualitative and quantitative research, which allows you to systematically integrate research into a single structured data analysis process. For this purpose, the matrix of consistency of intercoder is used, which in their opinion guarantees the development of a concise scheme of categorical development.

For many education systems, one of the main factors in the development of quality education is the availability of objective data on learning outcomes under educational standards. One way to obtain such data is to organize and conduct monitoring research, as monitoring the essence - an information system, under the process, creating conditions for management decisions, implementation - technology to assess the current state of management, its regulation and development forecast. Therefore, information systems use information processes (English Information processes) - a consistent change in the state and perception of information as a result of actions that can be performed with it. Such actions are - creation, collection, storage, processing (analysis), reproduction, transmission, distribution, use and protection of information.

Most organizations being in the process of strategic management use quality tools to achieve various goals related to quality control and assurance (Luca, 2016). Strategic quality management tools are quite general and can be applied in any environment for various industries and organizations. Also, these tools can provide a lot of information about problems in the organization that help to find sound solutions. One of the most common and systematic tools for strategic control and quality assurance in education is the Ishikawa diagram (Slameto, 2016). Thanks to this cause-and-effect diagram, leaders of organizations can achieve significant and concrete changes in quality improvement.

The outlined aspects in the field of education are the most problematic and widespread, established, systemic and important for the citizens of Ukraine, in particular. They also cover the national education sector from preschool to higher education. Under those circumstances, further research and the search for effective ways to develop education should be integrated into the development strategy of the educational institution.

The hypothesis of the given study is that computer and e-learning technologies are to contribute to the university's strategic development in a list of diverse directions.

The purpose of the study is to substantiate and elaborate the crucial causes in the strategic management of university's development and to suggest the coherent prospects for advancements.

The objectives of the study are as follows: to elaborate the information support of the university strategy; to determine causes for improving the strategy of university; to provide the opportunities of further university's strategic development.

The object of the study is the strategic development of a university. The subject of the study is the management elements, which corresponds to the main categories of university development.

The following methods of economic research were used to solve the objectives: the data analysis was performed using descriptive methods (to identify the most significant causes that affect the university's strategic development); the expert assessment (allows to rank the factors, ultimately to assess each factor that affects to some extent the university's strategic development); the abstract-logical method (made it possible to prove the positive impact of computer technologies and e-learning on the strategic development of a university and to formulate proposals for its further progress).

## 2. Methodology and Results

To consider the university's development strategy such a tool as the causal diagram of Ishikawa was used – a tool that allows to identify the most significant causes (factors) that affect the final result (consequence) (Ishikawa et al., 1990). The Ishikawa diagram clearly shows the work on improving the quality of production processes. It is a tool for visualization and organization of knowledge, which systematically facilitates the understanding of the causes and consequences of certain actions in the management process. In the literature this diagram is also called the "fish skeleton". The problem under study is the "fish skeleton head". "Backbone" is conventionally depicted as a straight horizontal arrow, "bones" - the reasons - are depicted by inclined arrows. The analysis provided should identify and record all the reasons, even those that seem insignificant, because the purpose of the diagram is to find the most correct and effective way to solve the problem. In fact, the maximum depth of such a "skeleton" reaches four or five levels. It is impossible or unprofitable to take into account all identified and recorded factors in the strategy. It is needed to identify the most important causes and manage them. The ranking of the causes is carried out by an expert method, in particular by the method of brainstorming. The given study had been provided with the Ishikawa diagram

was carried out in several stages: identification and collection of all factors and causes that affect the final result; grouping of factors by the level of influence and causal blocks; ranking of factors within each block; analysis of the acquired picture; "exclusion" of factors that we cannot influence; ignoring insignificant and unprincipled factors. The given study has relied on the following benefits of the Ishikawa Diagram: allowance to display the relationship of the studied matter and the reasons that affect this problem graphically; possibility of conducting a meaningful analysis of the chain of interdependent causes that affect the problem; convenience and ease for the application and understanding by the personnel. High-skilled employees are not required to work with the chart, and there is no need for long-term training. In the given study, we aimed to build a diagram of Ishikawa and interpret the assessment of the main causes. The main task was the strategic development of the university. The Ishikawa diagram acquired as a result of the composition of

five management elements, which corresponds to the main categories of university development (expanding access to educational services, development of scientific and innovative activities, intensification and diversification of international activities, updating material and technical base and improving the social well-being of university staff, confirming the status of a research university). To apply the Ishikawa diagram, qualitative data were gathered by engaging management experts and conducting interviews with stakeholders. Quantitative data were acquired as a result of the expert's evaluation in product development project management, content analysis of educational standards and experiments. Figure 1 depicts that the core causes, level 1 factors and level 2 factors. The impact on the result is determined by the core causes.

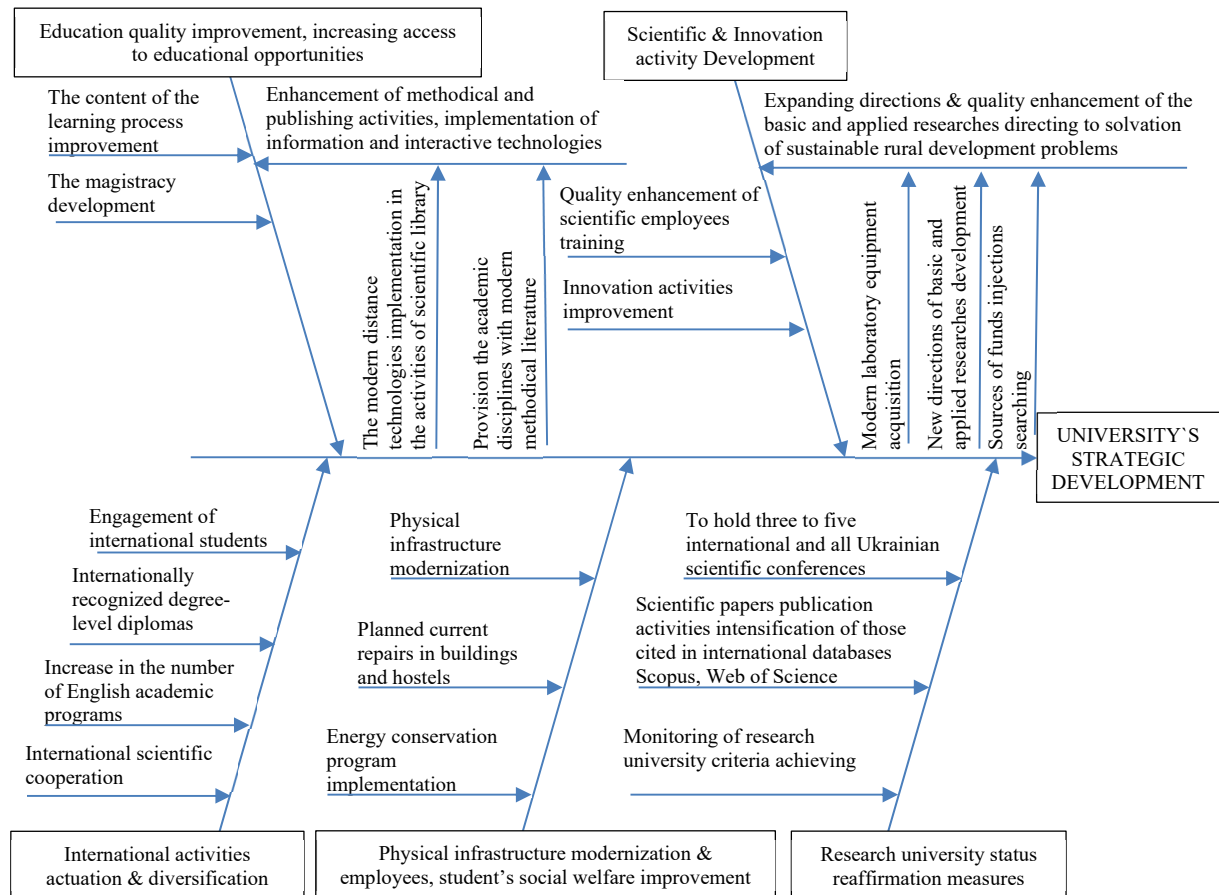


Fig. 1 Ishikawa diagram on the example of information support of the university strategy

The next step is to identify the crucial elements that affect the quality score and the best way to verify the evaluation of the components. After the hierarchical

reproduction of the problem, it is necessary to set the priorities of the criteria and evaluate each of the alternatives according to the criteria, identifying crucial ones. To do so, the choice of the best way to verify the observations, tests

and evaluation of the elements is carried out - the priorities of the criteria and the evaluation of each of the alternatives identified by pairwise comparison.

The matrix of quantitative statements has next form:

$$A = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{bmatrix} \quad (1)$$

Since the values of the criteria are unknown at the first stage, they are numerically evaluated on a scale of relative importance using subjective, logically constructed judgments. The Standard Scale of Relative Importance (SSRI) is as follows (table 1).

**Table 1:** The Standard Scale of Relative Importance

Degree of importance	Definition	Disclosure
1	Equal importance	The two elements make the same contribution to meet targets
3	Some advantage of one element over another (low importance)	Experience and reflection give a slight advantage of one element over another
5	Significant or strong advantage	Experience and reflection give a strong advantage of one element over another
7	Very strong or obvious advantage	The advantage of one element over another is very strong
9	An absolute advantage	Evidence in favor of the superiority of one element over another in the highest degree
2,4,6,8	Intermediate values	Situation for a compromise solution
Inverse values	If when comparing object i with j the selected number corresponds, then object j when comparing with i corresponds to the inverse value	Reasonable statement

Source: Diakoulaki et al., 1995

The matrix for the studied case has the form M1 (5x5) - 25 cells. Thus, the diagonal could be immediately filled. Diagonally, the matrix has equal importance (1) – the comparison of the element with itself, so the diagonal contains only figures one. Each of these matrices – pair comparisons – is square, so it has the properties of inverse symmetry, an equal number of rows and columns. When determining the relative importance, it is several elements in pairs compared as follows: which one is more important, significant, notable, better, probable, has a greater impact. For the rest, after filling the diagonal of 20 cells, it is needed to make ten pairwise comparisons of the elements located in the upper and left part of the matrix with each other, because the others ten are inverse comparisons. Their estimates should be inverse to the estimates of the first ten. If the element in the left part is more important than in the top, we choose the whole positive value, if, on the contrary, the inverse value should be chosen. The comparison is made in pairs from the upper right corner

relative to the diagonal. In the lower-left part of the matrix enter the inverse values. The first cause was to improve the quality of education, as it is the highest priority according to the survey, as it has been covered above.

Markings:

- cause 1 – improving the quality of education, expanding access to educational services;
- cause 2 – the development of scientific and innovative activities;
- cause 3 – intensification and diversification of international activities;
- cause 4 – updating the material and technical base and improving the social well-being of staff and students;
- cause 5 – measures to confirm the status of the research university.

Table 2 represents the matrix of pairwise comparisons for “Information support of university’s strategy accomplishment” (table 2).

**Table 2:** Matrix of Pairwise Comparisons for Information Support of University’s Strategy Accomplishment

	Cause 1	Cause 2	Cause 3	Cause 4	Cause 5
Cause 1	1	4	5	7	2
Cause 2	1/4	1	3	5	2
Cause 3	1/5	1/3	1	3	2
Cause 4	1/7	1/5	1/3	1	1/4
Cause 5	1/2	1/2	1/2	4	1

Next, calculations of the value of the priority vector were carried out - the calculation of the main eigenvector, which after normalization becomes a vector of priorities.

When calculating the estimates of the eigenvector  $a_i$ , a calculation consisting of several stages was performed:

1) Multiply the  $j$  elements of each row and subtract the  $j$ -degree root:

$$\begin{aligned}
 a_1 &= \sqrt[j]{1 \cdot a_{12} \cdot \dots \cdot a_{1j}}, \\
 a_2 &= \sqrt[j]{\frac{1}{a_{12}} \cdot 1 \cdot \dots \cdot a_{2j}}, \\
 &\dots \\
 a_j &= \sqrt[j]{\frac{1}{a_{1j}} \cdot \frac{1}{a_{2j}} \cdot \dots \cdot 1},
 \end{aligned}
 \tag{2}$$

where  $j$  is the order of the matrix of weight judgments.

Calculate the estimates of the component of the eigenvector on the lines:

$$\begin{aligned}
 a_1 &= \sqrt[5]{1 \times 4 \times 5 \times 7 \times 2} = 3,086 \\
 a_2 &= \sqrt[5]{\frac{1}{4} \times 1 \times 3 \times 5 \times 2} = 1,496 \\
 a_3 &= \sqrt[5]{\frac{1}{5} \times \frac{1}{3} \times 1 \times 3 \times 2} = 0,833 \\
 a_4 &= \sqrt[5]{\frac{1}{7} \times \frac{1}{5} \times \frac{1}{3} \times 1 \times \frac{1}{4}} = 0,299 \\
 a_5 &= \sqrt[5]{\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times 4 \times 1} = 0,871
 \end{aligned}$$

2) The evaluation of the priority vector could be obtained by normalizing the value of each evaluation of the components of the eigenvector by lines (each value of the evaluation of the components of the eigenvector by lines divided by the sum of these values):

$$\begin{aligned}
 x_i &= \frac{a_i}{\sum a_{ij}} \\
 \sum a_{ij} &= 6,584 \\
 x_1 &= \frac{3,086}{6,584} = 0,469 \\
 x_2 &= \frac{1,496}{6,584} = 0,227 \\
 x_3 &= \frac{0,833}{6,584} = 0,126 \\
 &\dots \\
 x_4 &= \frac{0,299}{6,584} = 0,045 \\
 x_5 &= \frac{0,871}{6,584} = 0,132 \\
 \sum x_i &= 1,000
 \end{aligned}
 \tag{3}$$

Next, it is necessary to calculate the consistency index (CI) of expert assessments for the reconciliation of the

initial evaluations. CI shows the degree of deviation of consistency. CI can take values from 0 – with full consistency to 1 – with no consistency. To improve consistency, it is recommended to review the data, search for additional information and possibly get rid of insignificant factors.

To determine the maximum or principal eigenvalue  $\lambda_{max}$  of the inversely symmetric matrix it is necessary to obtain a component for calculating the consistency index  $\lambda_i$ .  $\lambda_{max}$  of the inversely symmetric matrix is used to estimate consistency that consequently reflects the proportionality of the advantage.

To do so, it is necessary to determine the sum of the column and multiply it by the component of the normalized priority vector of the corresponding row as follows:

$$\begin{aligned}
 \lambda_i &= (a_{i1} + a_{i2} + \dots + a_{ij}) \times x_i \\
 \lambda_1 &= \left(1 + \frac{1}{4} + \frac{1}{5} + \frac{1}{7} + \frac{1}{2}\right) \times 0,469 = 0,981 \\
 \lambda_2 &= \left(4 + 1 + \frac{1}{3} + \frac{1}{5} + \frac{1}{2}\right) \times 0,227 = 1,371 \\
 \lambda_3 &= \left(5 + 3 + 1 + \frac{1}{3} + \frac{1}{2}\right) \times 0,126 = 1,243 \\
 \lambda_4 &= (7 + 5 + 3 + 1 + 4) \times 0,045 = 0,908 \\
 \lambda_5 &= \left(2 + 2 + 2 + \frac{1}{4} + 1\right) \times 0,132 = 0,959 \\
 \lambda_{max} &= 5,461
 \end{aligned}
 \tag{4}$$

To assess the consistency of the expert's judgments, it is necessary to use the deviation of the value of the maximum eigenvalue from the order of the matrix. The consistency index is calculated with the formula:

$$CI = \frac{\lambda_{max} - i}{i - 1}
 \tag{5}$$

where  $i$  is the order of the matrix – the number of columns (rows) in the matrix.

The consistency ratio (CR) is found as the ratio of the consistency index to the random consistency (RS):

$$CR = \frac{CI}{RS}
 \tag{6}$$

It is a table of correspondence of the order of the matrix and RS represented below (table 3). The determination has been provided on the basis of 100 random samples.

**Table 3:** The Table of Matrix Order and RS Correspondence

Matrix order	1	2	3	4	5	6	7	8	9	10
RS	0,00	0,00	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

$$CR = \frac{0,11}{1,12} = 0,10$$

It is for clarity that the calculated indicators are listed in table 4.

**Table 4:** Presentation of Findings

Cause	1	2	3	4	5	a <sub>i</sub>	x <sub>i</sub>
1	1	4	5	7	2	3,086	0,469
2	1/4	1	3	5	2	1,496	0,227
3	1/5	1/3	1	3	2	0,833	0,126
4	1/7	1/5	1/3	1	1/4	0,299	0,045
5	1/2	1/2	1/2	4	1	0,871	0,132
Σ						6,584	1,000
λ <sub>i</sub>	0,981	1,371	1,243	0,908	0,959		
Maximum eigevalue						λ <sub>max</sub>	5,461
CI							0,11
CR							0,10

Lack of consistency is a limiting factor in the study of problems and solutions: the rank of the matrix is different from one and it is to have several eigenvalues. But, in practice, perfect consistency cannot be achieved, there may be some deviations from consistency, which are defined by some limits: the consistency ratio must be less than or equal to 0.1 (10%) to be acceptable. If the percentage for the matrix of pairwise comparisons is higher, it indicates a significant violation of the logic of judgments, committed by the expert when filling the matrix, so the expert is asked to review the data used to build the matrix to increase consistency.

To conclude our specific case, it is necessary to note that in our case the ratio of consistency is 10%, which indicates the adequacy and logic of judgments about the case under study.

For each position in the construction of the cause-and-effect diagram is put a weighting factor – a vector of priorities that shows the significance.

We will analyze the results of determining the priority reasons for the impact on the information support of the university strategy:

The most priority or significant is the cause 1 – improving the quality of education, expanding access to educational services (0.469). In the second place, cause 2 – the development of scientific and innovative activities (0.227). On the third cause 5 – measures to confirm the status of the research university (0,132). On the fourth cause 3 – intensification and diversification of international activities (0.126). The least important cause is 4 – updating the material and technical base and improving the social well-being of staff and students (0.045).

The consistency ratio that indicates the adequacy and logic of the correctness of judgments to assess the reasons that directly affect the information strategy of the university is 10%. Consequently, we can state that the chosen causes are significant and most important for

improving the quality of education, expanding access to educational services.

The reason for updating the physical infrastructure and improving the social well-being of staff and students, although it has the least importance it needs to be improved. Because without material and technical base there will be no computers for students to work at the university.

The rapid development of computer technology and the expansion of its functionality allows its widespread use at all stages of the educational process.

It is common knowledge that the motive in the development of the students' cognitive interests is their independent performance of creative tasks, creation, and solution of problem situations, practical and laboratory work, the use of visual aids. Students have to be able to both listen and think to complete tasks. We argue that when performing findings, the 80% of what a person does is remembered actually. The teacher, in turn, must remember that he must develop in students a high level of thinking and, in turn, see the result of their work. After all, how he conveyed the information (whether in person in pairs or e-courses) depends on the result of students' work, their interest in a particular discipline. This information should be more practical than theoretical. After all, according to our survey, students say that they have no motivation, and teachers agree. Students would like the tasks to be more diverse, the information to be more reasonable and clear, the presentations to be comprehensive, and the courses to be more thought-provoking and conform to high-quality standards. It is crucial that the psychological atmosphere in which students are were convenient. That is why trying to encourage even a small student's success would be useful. It is necessary to build such a structure that there is a constant desire for knowledge and self-improvement. It is necessary to trust students and support their aspirations in every possible way. It is possible to use a whole arsenal of interactive learning tools: experiments, blitz



tournament, "brainstorming", a lecture with a solution to the problem, an integrated lesson, a journey-lesson, the most important method, in our opinion, is to use a resource of computer technology. It is of high importance to teach students to apply their knowledge in new and unusual situations, to develop elements of creative thinking. We are convinced that new information technologies in education contribute to the disclosure, preservation, and development of individual abilities of participants in the educational process; formation of cognitive qualities; striving for self-improvement; ensuring the complexity of the study of the phenomena of reality; inseparability of the relationship between technology, humanities, arts, applied sciences, daily dynamic updating of the content, forms and methods of teaching and education. The teacher has the opportunity to effectively organize the control of knowledge, skills, and abilities; use study time economically; adjust the learning process by providing feedback to students; expand and combine types of work with students; create conditions for the implementation of the individual and differentiated approach.

Following the result of the study, 66.1% of students would like to study remotely, but teachers are not ready to shift completely to distance learning on a full-time basis. Accordingly, it is necessary to consider the prospects for the use of e-learning technologies.

Currently, the use of e-learning technologies is coming to the fore in education all over the world. It is most relevant in the context of university education, where there is a process of the predominance of modern pedagogical technologies, including e-learning technologies, over traditional ones.

Modern pedagogical technologies, and to a greater extent e-learning technologies, are personality-oriented and aimed at the development of students' individual resources.

Regarding the psychological aspect of assessing the knowledge of participants in the learning process, electronic learning technologies provide an opportunity to reduce the role of stressors in the process of passing tests and exams, as well as increase the level of psychological comfort in the classroom. The use of electronic teaching methods in universities allows to increase the level of education and improve the quality of educational services provided by higher education institutions, as well as provides greater flexibility in the implementation of educational goals of higher education.

Without any doubt, the Internet played a crucial role in the development of e-learning. E-learning enables educational institutions to increase productivity, reduce face-to-face costs, improve knowledge sharing, and minimize tuition costs.

In addition, the Internet provides an opportunity to diversify the content and methods of teaching. As a result,

there is a need to systematize resources suitable for teaching and education. You can do this on the site [elearn.nubip.edu.ua](http://elearn.nubip.edu.ua). All in all, it is possible to view e-courses made by teachers and find all the news about the life of the university on the websites.

The usage of electronic learning technologies at the university allows:

- to expand the range of high-quality educational services provided by the university and ensure its sustainability from the moment of planning the course to its completion;
- to increase efficiency when students pass exams;
- to increase the attractiveness of the studied material by improving the conditions of education;
- to expand opportunities for professional growth and professional development of teachers;
- to provide teachers with more space to study the experience of colleagues and retraining;
- to increase the number of students of the educational institution who are studying at the same time;
- to reduce the study load of students;
- to ensure more efficient, timely updating and dissemination of educational resources, as well as increase their availability;
- to ensure the continuity of student learning by removing spatial and temporal constraints;
- to provide a personal schedule of students and a list of training courses, taking into account their interests within the standard of education;
- to conduct intermediate and final certification in the form of testing;
- to increase the effectiveness of feedback for university teachers and students, etc.

Therefore, a number of factors need to be considered that, in unity and interconnectedness, can ensure the intensity and, consequently, the effectiveness of learning. Among them: organization of the educational process on a scientific basis, ensuring a high level of psychological and pedagogical training of scientific and pedagogical staff, optimizing the content of educational material in terms of age and individual abilities of students, humanization and humanitarianization of the educational process, creating appropriate sanitary conditions for learning (nutrition, compliance with the requirements of air, light, heat regimes, mental health hygiene), extensive use of technical teaching aids, professional mastery of pedagogical technologies and pedagogical techniques.

The information society requires a person to acquire the ability and skills to independently acquire and use knowledge in a non-standard way, to master information technologies of their search, comprehension, deepening and application, which become an organic need of each person. To deepen knowledge in the field of information technology, to learn to apply them in the teaching of

various subjects, many teachers choose postgraduate study in the field of information technology.

Given is actively promoted by the modern system of continuing education, a component of which is a distance form of education, which is carried out on the basis of modern pedagogical, information and telecommunication technologies. It has developed significantly over the last decade and is the most effective in solving many problems. The use of distance learning is an effective support for the learning process. This allows to: provide participants in the educational process with different levels of educational information; create conditions for equal access to quality education; expand the range of educational services using smart TV, radio, Web resources; to increase the information competence of teachers and students.

### 3. Conclusions

Based on the above, we can conclude that the use of electronic learning technologies in higher education makes a positive effect on the psychological and pedagogical aspect of the educational process, including the development of individual skills of students and teachers, forms goal-setting skills, independent thinking, initiative and responsibility for the work performed, as well as reduces the psychological burden on students and teachers in the process of mutual exchange of knowledge.

The development of students and the quality of their assimilation of knowledge and the mastering of independent work skills largely depend on teaching methods. It is possible to increase the efficiency of the educational process, to reach high intellectual development of students using modern innovative technologies, and in particular, technologies of interactive training. They require careful teacher training. With such an organization of the educational process, a student can't be passive in a collective complementary process based on the interaction of all its participants. In joint learning, students, working in groups, provide the most effective learning process for themselves and their classmates. Improving the effectiveness of the learning process is done through careful analysis of how team members work together and identifying ways to improve the effectiveness of this work. A relevant way to increase the efficiency of the educational and cognitive process is the use of technical teaching aids, including computer equipment. The use of technical teaching means gives educational and methodical work with students a more saturated, dynamic, creative, and intensive character. The use of technical teaching means increases the efficiency of the educational process, enhances the assimilation of educational material, and their development and

determination of areas of application is a significant component of methodological work at the university.

A vital guarantee of improving the efficiency of the educational process is the enrichment of trivial educational material with information about the latest research and development of world science, new theories and inventions, current issues, and current trends in science in general and in particular. An integral part of the process of learning intensification is the transfer of theoretical foundations of the discipline into practice, allowing students to test the theory in action, as close as possible to the real conditions of its practical application, use of laboratory stands, and equipment, acquaintance with enterprises where this theory used. Should universities provide presented suggestions this will help to effectively prepare students for future careers.

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