FORMATION OF RESOURCE POTENTIAL OF HEIS AS A BASIS FOR THEIR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Objectives: The idea of the article is that the sustainable development of higher education institutions depends on their available resource potential. The purpose of this article was to create a methodological toolkit for assessing HEI's resource potential as a basis for their sustainable development. Methods/Approach: In the research, an assessment of the resource potential of higher education institutions (in the example of Kremenchuk Mykhailo Ostrohradskyi National University) was carried out by determining the integral indicator. An integral approach to assessing the resource potential of a higher education institution involves the synthesis of indicators that demonstrate the achieved results by elements: HR, financial, organizational, material and technical, and informational. Results: The determination of the integral indicator for three years shows that in 2019 the indicator was within the sufficient level, and in 2020-2021 it reached an average level. If we consider the levels of development of indicators by elements, then the largest indicator is determined by the material, technical and informational elements. High indicators for the entire analyzed period were achieved by the personnel element. A mathematical model was built based on the results of the first-order experiment. Conclusions: It was determined that personnel and material and technical elements have the greatest influence on the formation of competitive advantages. Identifying the key components of the resource capacity that significantly influence its growth enables management of a HEI to gain better insights into their capability to accomplish sustainable development objectives. The outcomes derived from constructing a mathematical model facilitate the identification of factors shaping the resource capacity of the institution across various timeframes. The novelty of our proposed evaluation methodology lies precisely in the new system of indicators for evaluating the resource potential of universities.

Keywords: resource potential, sustainable development, higher education institution, integral indicator

JEL Classification: I23; M10; Q01; A20

Paper type: Research Paper

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INTRODUCTION

A modern global strategic trend is the formation of a dynamic concept of education in the interest of the sustainable development of communities (Dyachenko et al., 2018; Uteubayev, Petrova, Lyubenova, 2018; Zagorodnya, Chemukha, Petrova, 2020). Education has a significant impact on society's response to national,
regional, and global challenges and opportunities brought by sustainable development. According to the «Global Sustainable Development Goals 2016-2030» adopted by world leaders at the UN Summit in September 2015, ensuring inclusive, fair, quality education and encouraging lifelong learning opportunities is one of the priority goals of the development of world society. Institutions of higher education have a special role in this process (Education for sustainable development, 2015).

Until 2022, higher education institutions of Ukraine functioned in conditions of variability in the demand for educational services from consumers due to various factors: demographic fluctuations, competition from foreign universities, and a decrease in the purchasing power of the population. Such a disparity has led to the outflow of potential applicants from the regions to the largest cities, a reduction in the funding of regional universities, internal and external migration of teachers, etc., which has a significant impact on the sustainable development of higher education institutions.

Russia's military aggression against Ukraine has led to the development of crisis processes in the higher education system. This is manifested in the fact that traditional methods of conducting the educational process cannot be applied, as the material base has been virtually destroyed, and teachers and students are in different regions of the country or even abroad due to forced evacuation. At the same time, the problem of training the required number of specialists with higher education in a particular field, who are needed to restore and develop the national economy, is becoming more acute. Priority attention should be given to the problems caused by the war, in particular: restoration and development of the infrastructure of higher education institutions, restoring the human resources of educational institutions, functioning of the education system in conditions of limited funding (War in Ukraine: Reshaping the Higher Education Sector Analytical Report, 2023).

Sustainable development in times of war is a complex concept. However, even in the context of hostilities, higher education institutions strive to ensure internal sustainability. Internal sustainability, namely the preservation and enhancement of resource potential, will provide opportunities to overcome the crisis and rebuild the national economy after the war. Under such conditions, in order to ensure its own sustainable development, a higher education institution should focus on its own resource potential. An important problem today is the development of effective tools that will allow higher education institutions to quickly and objectively assess their resource potential.

THEORETICAL BASIS

This literature review is organized as follows. The first section provides insights into the conceptual basics of the impacts of HEIs on Sustainable Development. The second section contains findings about which tools for assessing sustainability in higher education are used by researchers.
Impacts of Higher Education Institutions on Sustainable Development

W. Purcell, H. Henriksen, and J. Spengler found in their research that the collegial nature of the higher education sector, with its shared governance models and diverse groups and performance drivers, means that sustainability at a strategic level must be managed with leaders at all levels acting with purpose. The «Living Labs» model can become part of transformative institutional changes that rely on both top-down and top-down strategies of higher education in pursuit of sustainable development (Purcell et al, 2019).

A. Omazic, and B. Zunk research the implementation of sustainable strategies in German higher education institutions. Considers a set of approaches to how universities can implement a holistic concept of sustainable development that takes into account all three dimensions (economic, environmental, and social) related to their core research and education functions about their organization. In addition, the authors analyze the current state of implementation of sustainable development strategies in universities, as well as how to evaluate the success of these efforts and promote further development (Omazic & Zunk, 2021).

The work of the team of authors A. Lazarov, and A. Semenescu considered the barriers and problems faced by HEIs in Romania to achieve the goals of sustainable development, such: insufficient funding, lack of experienced specialists in developing a strategy for the sustainable development of HEIs, difficulties and changes in state policy (Lazarov & Semenescu, 2022).

Scientists G. Finnveden, E. Friman, A. Mogren, H. Palmer, P. Sund, G. Carstedt, S. Lundberg and B. Robertsson (Finnveden et al., 2020) dealt with the issues of the integration of the principles of sustainable development into the activities of higher education institutions. The study of the authors' data is interesting because the entire higher education sector in Sweden was evaluated. Thus, this evaluation provides a unique material open to comparisons and a better understanding of the aspects that contribute to the successful implementation of education for sustainable development.

The article by the team of authors I. Buzko, O. Vartanova, proved that the impact of the potential of using information technologies on the socio-economic development of the country and the quality of life of every citizen currently depends on the development of the higher education sector. The paper studies the modern possibilities of using information technologies, namely, the adaptation of accounting and analytical support in the context of the diffusion of socio-economic values to improve the welfare of the population (Buzko et al., 2019).

The article by C. Rinaldi, A. Cavicchi, F. Spigarelli, L. Lacchè, and A. Rubens (C. Rinaldi et al., 2018) explores the potential contribution that social and humanities universities can offer in developing and strengthening capacity, supporting the changing concept of innovation in a coherent using the Smart Specialization Strategy approach (S3). In the third and fourth missions, universities can play roles (generative, absorptive, collaborative, and leadership) that could support regions in the development and implementation of S3.
The authors I. Trunina, I. Khovrak proposed a mechanism for the influence of universities on sustainable development through the implementation of the concept of social responsibility, which in the future will allow universities to take an active part in the life of the region and the country, namely: identify needs, involve stakeholders, promote interaction, spread effective practices and develop sustainable strategies development (Trunina, 2021).

Scientists F. Findler, N. Schönherr, R. Lozano, D. Reider and André Martinuzzi (Findler et al., 2019) believe that HEIs have an inherent responsibility to make societies more sustainable. HEIs must embed SD into their systems while considering their impacts on society. In article the current state of the Chinese-Ukrainian relations is analysed, the priority directions of strategic cooperation are considered. One of them - sustainable development of educational sphere (Kratt et al., 2017). The authors Ruihui Pu, Danai Tanamee and Songyu Jiang attempted to explain the impact of digitalization on the sustainable development of universities. The authors concluded that higher education institutions should improve digital teaching, the quality of education through innovation, technological development, resource utilization, and development through the creation of a better digital platform or environment are essential to truly promote HESD (Ruihui Pu et al., 2022).

**Sustainability Assessment Tools in Higher Education**

The research of the authors A. Schlickmann, E. Pinheiro de Lima, and S. Bortoluzzi focuses on the definition of the main sustainability assessment tools in higher education, among which the authors single out the Global Reporting Initiative (GRI) tool and the Graphical Assessment of Sustainability in Universities (GASU) tool, which stood out among the models used in sustainability reporting, the Sustainability Tracking, Assessment and Rating System (STARS), distinguished between higher education institutions – Specific assessment tools and audit tools for sustainability in higher education (AISHE) and sustainability tools for the holistic assessment of university curricula (STAUNCH) stood out in the educational dimension. (Schlickmann et al., 2021).

Researchers Gupta and Singhal (2017) concluded that the impact on sustainable development occurs through the core elements of the higher education system. Sustainability activities in these core elements generate overall social, environmental and economic impacts (Gupta and Singhal, 2017).

The team of authors A. Silva Junior, P. Martins-Silva, K. Vasconcelos, V. Silva, M. Melo, and M. Dumer (Silva Junior et al., 2018) in the conducted study proposes to create an academic category consisting of four subcategories – institutional, university management, financial, and social, and environmental responsibility. These categories include a set of sustainability indicators that measure and reveal higher education institutions' sustainability practices and actions using mixed methods (quantitative and qualitative) and complementary evaluation strategies. From the point of view of the management of a higher education institution, the results of the study provide tools for quantitative and qualitative assessment of activities based on several criteria. About the social dimension, this set of indicators provides society with a means to
assess higher education institutions' sustainability practices and actions, as well as their economic, social, environmental, and academic impacts.

Some authors (Linde & Petrova, 2018; Petrova, Buzko, Dyachenko, 2018) believe that to achieve the goals of sustainable development, a higher education institution must develop, launch, implement, and configure an architecture of specific processes to guide the promotion of a sustainable development approach. The authors applied the SIPOC (Supplier, Input, Process, Output, Customer) method, and with the help of the Visio software tool, the process architecture was formulated and built into the educational model of higher education institutions (Fleacă et al., 2018).

In the study of the authors S. Elmassah, M. Biltagy, and D. Gamal (Elmassah et al., 2022), a framework for the analysis and assessment of sustainable development of a higher education institution is presented, which directs HEIs and management to support the principles of sustainable development to fulfill the obligations of their countries to achieve the goals of sustainable development. This framework is based on the following five categories: strategic direction and institutional work practices, student support, university staff competency support, community stakeholder support, and a sustainable campus. The potential role of a higher education institution in supporting sustainable development in each of these areas is considered.

However, in our opinion, an essential component in achieving the goals of sustainable development of higher education institutions is their resource potential. The lack of ability of the higher educational institution to integrate the principles and practices of sustainable development in all aspects of education and training is due to the insufficient resource base possessed by the higher education institution.

The purpose of this article was to create a methodological toolkit for assessing HEI's resource potential as a basis for their sustainable development.

RESULTS

The results of the research include a description of the methodology and approbation of the result on the basis of the Kremenchuk Mykhailo Ostrohradskyi National University.

Resource potential assessment methodology

Resource potential is considered a basic component of sustainable development of higher education institutions, which is characterized by the following elements: personnel, material and technical, organizational, financial, and informational. The essence of the assessment methodology proposed in this study is the calculation of the integral indicator of the resource potential as the arithmetic mean value of the sums of the potentials for each structural element. The following structure of resource potential was proposed in the study (fig. 1).

The determination of the integral indicator of the assessment of the resource potential of a higher educational institution provides the synthesis of indicators that demonstrate the achieved results by elements: HR, financial, organizational, material and technical, and informational (fig. 1).
To characterize each element of the resource potential, it is necessary to use appropriate indicators. In Figure 1, we offer the following system of indicators for the structural elements of the resource potential, discussed below. To transform indicators for each element of resource potential to ensure their comparability, it is necessary to calculate coefficients (weights) that take into account the significance of the influence of the indicator on the corresponding component of the resource potential of the HEI. For this purpose, the method of paired preferences was used, which is based on a paired comparison of alternatives. In this study, a pairwise comparison of indicators of resource potential elements was made and the best
indicator, which has the greatest impact on the resource potential of a higher education institution, was identified. For pairwise comparisons, T. Saati’s algorithm was used in this case, which is based on the comparison of alternatives performed by one expert. For each pair of alternatives, the expert indicates to what extent one of them prevails over the other. Thus, a pairwise comparison of the indicators of each group of resource potential elements was carried out using this method and the calculated weights of the indicators of each group. To simplify calculations, the sum of rows of the comparison matrix was used as the price of the indicator.

Next, the final sum of the indicators is determined as an algebraic sum of the prices of each indicator of the resource potential. Indicator weights are determined by the following formula:

\[ V_i = \frac{H_i}{\sum H_i} \]  

\( V_i \) – the importance weight of the i-th indicator; 
\( H_i \) – the price of the i-th indicator of the resource potential element; 
\( \sum H_i \) – the sum of the values of the indicators of the resource potential elements.

At the next stage of calculating the elements of the resource potential of the institution of HEI, it is necessary to standardize the features. In our case, all selected indicators are stimulating indicators. To calculate such indicators, we will use the formula:

\[ x_i = \frac{x_{ij}}{x_{i,\text{max}}} , \]  

\( x_i \) – the unified value of the indicator of the i-th element of the resource potential; 
\( x_{ij} \) – the actual value of the indicator of the i-th element of the resource potential; 
\( x_{i,\text{max}} \) – the desired value of the indicator of the i-th element of the resource potential.

The level of development for each element \((H_p, M_p, I_p, O_p, F_p)\) is proposed to calculate according to the formula:

\[ H_p = \sum_{i=0}^{n} \alpha \cdot x_i \]  

where \( \alpha \) – the weight of the i-th indicator of a separate element; \( x_i \) – standardized value of the i-th indicator of a separate element.

To determine the integral index of the level of development of the HEI’s resource potential, the formula of the geometric mean is used. The integral indicator formula will have the following form:

\[ I_p = \sqrt[n]{H_p \times M_p \times I_p \times O_p \times F_p} , \]  

where \( H_p, M_p, I_p, O_p, F_p \) – indices of the level of development by elements of resource potential - personnel, material and technical, informational, organizational, financial.
To interpret the estimated level of development of the HEI’s resource potential, it is recommended to use the adapted scale of Harrington’s desirability, which is shown in Table 1.

Table 1. Levels of development of the resource potential of higher education institutions by the Harrington scale

<table>
<thead>
<tr>
<th>Intervals of values</th>
<th>Characteristics of values</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 0.29</td>
<td>very low level of development</td>
</tr>
<tr>
<td>0.3 – 0.49</td>
<td>low level of development</td>
</tr>
<tr>
<td>0.5 – 0.63</td>
<td>sufficient level of development</td>
</tr>
<tr>
<td>0.64 – 0.80</td>
<td>the average level of development;</td>
</tr>
<tr>
<td>0.81 – 1.0</td>
<td>high level of development</td>
</tr>
</tbody>
</table>

According to the proposed scale, it is possible to conduct an analysis of the resource potential of higher education institutions and determine the most promising directions of measures from the point of view of sustainable development, both for the integral indicator in general and for the development of individual components.

The methodology identifies zones (components) of resource potential, the development of which is the most expedient to ensure the sustainable development of HEI’s. The selection of priorities for the development of resource potential by this methodology will be carried out based on an analysis of its resource state due to the ratio of the integral indicator of the higher education institution with the rank scale according to the main typical components. Thus, the implementation of special measures in higher education institutions regarding the development of resource potential and its components should be carried out on the condition that higher education institutions have accumulated components of resource potential of a lower level.

At the next stage of the research, the construction of a mathematical model will be carried out according to the method of first-order experiment planning, with the help of which it is possible to determine the key resources for a certain period according to the elements of the resource potential.

When conducting an experiment, it is necessary to strive for such a planning that guarantees obtaining maximum information without requiring a relatively large number of experiments. A fixed set of factor levels defines one of the possible states of the object. At the same time, these are conditions for conducting one of the possible experiments. If we go through all the possible states of the object, we will get the full number of possible experiments. If the number of levels for all factors is the same, then the number of possible experiments is found by the expression:

\[ N = p^k \]

where \( p \) – number of levels; \( k \) – the number of factors.

Any function can be represented by a polynomial expanded in a Taylor series. In our case, the polynomial has the form:

\[ y \approx a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 + a_{12} x_1 x_2 + a_{13} x_1 x_3 + a_{23} x_2 x_3 + a_{123} x_1 x_2 x_3 \]
During the experiment, we take 2 levels of parameter changes: \( p_{\text{min}} \) \( \rightarrow \) \( p_{\text{max}} \). Accordingly, the matrix of the experiment is determined (5):

\[
N = p^k = 3^2 = 8.
\]

According to the formula, three factors will be used to conduct the experiment, which will have the greatest importance. For convenience, it is advisable to present the conditions of the experiment in the form of a table - a matrix of the planning of the experiment. The matrix of the experiment is planned according to the number of variables \( k \) and the number of levels of parameter change \( p \).

The values in the matrix are written and coded according to the expression:

\[
Y_i = \frac{z}{H_{\text{min/max}} \times M_{\text{min/max}} \times F_{\text{min/max}}}
\]  \hspace{1cm} (7)

According to Harrington’s desirability scale, the maximum value for all elements is 1, the minimum value is 0.1. Calculation data are taken from Table 1. The general formula for calculating the coefficient of determination \( R^2 \):

\[
R^2 = \frac{\sum_{i=1}^{n} i( f_i - \bar{y})^2}{\sum_{i=1}^{n} i( y_i - \bar{y})^2};
\]  \hspace{1cm} (8)

If \( R^2 \) is close to 1, it means that the dependence between the factors is close to functional and the scatter of the observed data with the constructed regression line is very small.

Thus, by the first-order experiment planning method, it is possible to determine and mathematically confirm the pair of factors that have the greatest influence on the formation of the resource potential of a higher educational institution. It is on them that the management of a higher educational institution needs to focus on strategic planning to achieve the goals of sustainable development.

Assessment of the resource potential of higher education institutions (on the example of the Kremenchuk Mykhailo Ostrohradskyi National University)

The availability and rational use of certain amounts of resources is the most important condition for effective activity and makes it possible to carry out the production process and provide educational services. In the long-term perspective, the sustainable development of higher education institutions and effective activities are impossible without the implementation of a strategic approach, which involves the development and implementation of a development strategy that takes into account its resource potential.

The basis of the research on the assessment of the resource potential was chosen by Kremenchuk Mykhailo Ostrohradskyi National University.

The number of higher education students in 2021 during the pandemic totaled 3,690, which is 14% more than in the previous year (Fig. 2).
The number of academic staff of higher education institutions decreased by 14.4% during the study period. The most objective, independent criterion for the effectiveness of research work in a higher education institution is the number of publications prepared and published by its researchers and teaching staff. In 2021, a significant increase in the activity of publications of research and teaching staff in terms of publications in the Scopus database can be observed at the KrNU (fig 3).

As for the amount of funding for research, we can note a significant reduction in its share. 2020 accounted for the largest amount of funding for both general and special funds, with a decrease of almost 20% in 2021. As for the payroll fund, there was an increase during the analyzed period. Compared to 2020, funding for wages from the general and special funds in 2021 increased by 14.5%. The fixed assets renewal rate has a positive trend and increased by 63% compared to 2019. The value of fixed assets per student tends to increase. According to the methodology given in paragraph 2.1, the resource potential of the higher educational institution was calculated (Table 2).
Table 2. Calculation of values of elements of resource potential and integral indicator

<table>
<thead>
<tr>
<th>Element of resource potential</th>
<th>indicator weight</th>
<th>Kremenchuk Mykhailo Ostrohradskyi National University</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2019</td>
<td>2020</td>
</tr>
<tr>
<td>HR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$H_1$</td>
<td>0,03</td>
<td>0,0225</td>
</tr>
<tr>
<td>$H_2$</td>
<td>0,25</td>
<td>0,1125</td>
</tr>
<tr>
<td>$H_3$</td>
<td>0,33</td>
<td>0,099</td>
</tr>
<tr>
<td>$H_4$</td>
<td>0,17</td>
<td>0,1105</td>
</tr>
<tr>
<td>$H_5$</td>
<td>0,22</td>
<td>0,2464</td>
</tr>
<tr>
<td>The value of the element $H$</td>
<td></td>
<td>0,59</td>
</tr>
<tr>
<td>Material and technical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M_1$</td>
<td>0,17</td>
<td>0,2482</td>
</tr>
<tr>
<td>$M_2$</td>
<td>0,16</td>
<td>0,1024</td>
</tr>
<tr>
<td>$M_3$</td>
<td>0,24</td>
<td>0,2112</td>
</tr>
<tr>
<td>$M_4$</td>
<td>0,18</td>
<td>0,1296</td>
</tr>
<tr>
<td>$M_5$</td>
<td>0,25</td>
<td>0,095</td>
</tr>
<tr>
<td>The value of the element $M$</td>
<td></td>
<td>0,78</td>
</tr>
<tr>
<td>Informative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_1$</td>
<td>0,24</td>
<td>0,18</td>
</tr>
<tr>
<td>$I_2$</td>
<td>0,17</td>
<td>0</td>
</tr>
<tr>
<td>$I_3$</td>
<td>0,17</td>
<td>0,102</td>
</tr>
<tr>
<td>$I_4$</td>
<td>0,27</td>
<td>0,2484</td>
</tr>
<tr>
<td>$I_5$</td>
<td>0,15</td>
<td>0,09</td>
</tr>
<tr>
<td>The value of the element $I$</td>
<td></td>
<td>0,62</td>
</tr>
<tr>
<td>Organizational</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$O_1$</td>
<td>0,2</td>
<td>0,156</td>
</tr>
<tr>
<td>$O_2$</td>
<td>0,19</td>
<td>0,1729</td>
</tr>
<tr>
<td>$O_3$</td>
<td>0,1</td>
<td>0,1</td>
</tr>
<tr>
<td>$O_4$</td>
<td>0,18</td>
<td>0</td>
</tr>
<tr>
<td>$O_5$</td>
<td>0,32</td>
<td>0</td>
</tr>
<tr>
<td>The value of the element $O$</td>
<td></td>
<td>0,43</td>
</tr>
<tr>
<td>Financial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F_1$</td>
<td>0,31</td>
<td>0,062</td>
</tr>
<tr>
<td>$F_2$</td>
<td>0,22</td>
<td>0,1782</td>
</tr>
<tr>
<td>$F_3$</td>
<td>0,17</td>
<td>0,1819</td>
</tr>
<tr>
<td>$F_4$</td>
<td>0,17</td>
<td>0,187</td>
</tr>
<tr>
<td>$F_5$</td>
<td>0,13</td>
<td>0,078</td>
</tr>
<tr>
<td>The value of the element $F$</td>
<td></td>
<td>0,68</td>
</tr>
<tr>
<td>An integral indicator of the level of development</td>
<td>0,61</td>
<td>0,71</td>
</tr>
</tbody>
</table>

Thus, the determination of the integral indicator for three years shows that in 2019 the indicator was within a sufficient level, and in 2020-2021 it reached an average level. If we consider the levels of development of indicators by elements, then the largest indicator is determined by the material, technical and informational elements.
High indicators for the entire analyzed period were achieved by the personnel element (Fig. 5).

The results of the calculation of the integral indicator indicate of Kremenchuk Mykhailo Ostrohradskyi National University has a high resource potential, which is the basis of sustainable development and determines the sufficiency of resources in terms of the ability to integrate the principles and practices of sustainable development into all aspects of education and training.

Assessing the actual level of resource potential of higher education institutions will allow identifying key resources that will have an impact on achieving the goals of sustainable development.

Based on the results of the evaluation of the integral indicator to identify the factors that have the greatest impact on the resource potential of the higher educational institution, a regression equation was constructed using the first-order experiment planning method.

Three factors with the highest indicators of resource potential elements will be selected for modeling.
The study adopted the following factors for analysis (according to the above data of the calculation of the integral indicator of the resource potential by elements): $X_1 = H$ (HR-element), $X_2 = M$ (material and technical element), $X_3 = I$ (information element).

<table>
<thead>
<tr>
<th>number of experiment</th>
<th>factors</th>
<th>experiment</th>
<th>$Y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+</td>
<td>+</td>
<td>0,68</td>
</tr>
<tr>
<td>2</td>
<td>–</td>
<td>+</td>
<td>0,37</td>
</tr>
<tr>
<td>3</td>
<td>+</td>
<td>–</td>
<td>0,34</td>
</tr>
<tr>
<td>4</td>
<td>–</td>
<td>–</td>
<td>0,19</td>
</tr>
<tr>
<td>5</td>
<td>+</td>
<td>+</td>
<td>0,36</td>
</tr>
<tr>
<td>6</td>
<td>–</td>
<td>+</td>
<td>0,20</td>
</tr>
<tr>
<td>7</td>
<td>+</td>
<td>–</td>
<td>0,18</td>
</tr>
<tr>
<td>8</td>
<td>–</td>
<td>–</td>
<td>0,1</td>
</tr>
</tbody>
</table>

After constructing the experiment matrix in the STATGRAPHICS editor, the command is selected to construct standardized Pareto maps and mathematical model equations: Improve – Experimental Design Creation – Analyze Design. Standardized Pareto maps for control parameters are obtained $\bar{Y}$ (fig. 6) and the system of equations of the mathematical model in its general form.

In this case, the coefficient of determination for $\bar{Y}$ is calculated in the STATGRAPHICS editor and has a value

$R$-squared = 99,6147 percent

The equation describes the results of observations well. The model will look like this:
\[ \bar{y} = 0.31625 + 0.09625*X_1 + 0.10375*X_2 + 0.09875*X_3 + 0.03375*X_1*X_2 + 0.02875*X_1*X_3 + 0.03125*X_2*X_3 \]

The obtained model satisfies the requirements for adequacy according to the calculated coefficient of determination.

Regarding the Pareto map shown in Figure 6, it can be concluded that factor \(X_2\) has the greatest influence among the mentioned factors, moreover, if we consider the pair of factors, then factors \(X_1X_2\) exert the greatest influence on the resource potential of a higher education institution. Graphically, the influence of these two selected factors is shown in Figure 7.

Figure 7. Graph-analytical interpretation of the influence factors \(X_1, X_2\) on control parameters \(\bar{y}\)

So, as a result of the conducted experiment, it was found that HR element \(X_1\), and material, and technical element \(X_2\) have the greatest impact on the development of the resource potential of higher education institutions.

**DISCUSSION**

Resource potential is a complex system of interconnected elements, which, thanks to their interaction, achieves a synergistic effect: on the one hand, it ensures the achievement of a high level of competitiveness of higher educational institutions, and on the other, it is the basis for the sustainable development of a higher education institution.

Based on the results of the research, a mathematical model was built by conducting a first-order experiment to determine the influence of the components of the resource potential of higher education
institutions on sustainable development. Human factors and material and technical factors have the greatest influence on the sustainable development of higher education institutions.

The obtained results regarding the construction of a mathematical model allow monitoring the factors influencing the resource potential of a higher educational institution for any period. The assessment of the resource potential of the Mykhailo Ostrogradskyi Kremenchug National University indicates the expediency of increasing individual elements of the resource potential of the higher education institution to form such a level that would allow effective implementation of the strategic directions of sustainable development.

The proposed methodology for assessing the resource potential of higher educational institutions does not fully reflect the impact of digital transformation processes (Ruihui Pu et al, 2022). Therefore, in order to obtain more accurate results in future studies, it is necessary to expand the system of additional research indicators that can be used to determine the directions of sustainable development of universities.

Thus, in difficult, unfavorable conditions compared to pre-war conditions, higher education institutions are developing new experience in educational and research activities. The priority tasks are to ensure the resource potential as the basis for internal sustainability, quality of the educational process, while taking into account the goals and objectives of the post-war recovery and development of the country.

CONCLUSIONS

Negative phenomena such as increased migration, the emergence of foreign competitors, and the conditions caused by the global Covid-19 pandemic and the war significantly hamper the process of achieving the goals of sustainable development of higher education institutions.

The developed resource potential assessment method allows for the calculation of an integral indicator based on the values of the structural elements of the resource potential, which makes it possible to comprehensively characterize the resource potential of a higher education institution. The used method of calculating the resource potential of higher education institutions allows to obtain real data on the amount of potential available to each higher education institution, that is, the possibility or ability of higher educational institutions to develop a strategy for achieving the goals of sustainable development based on their available knowledge, skills, information, and material, financial, and organizational resources that are at their disposal.

Highlighting the elements of the resource potential that have the greatest impact on its development will allow the management of a higher education institution to get a clearer picture of the ability to implement and achieve the goals of sustainable development. The obtained results regarding the construction of a mathematical model allow for determining the factors influencing the resource potential of a higher education institution for any period. The creation of a certain resource potential assessment system will ensure not only measurement but also further strategic and operational management of a higher educational institution. This will make it possible to form a long-term strategy for the implementation of the principles
of sustainable development in the management practice of modern higher educational institutions. The novelty of our proposed assessment methodology lies precisely in the new system of indicators for assessing the resource potential of a higher educational institution. This system of indicators, on the one hand, allows you to assess the current state of the resource potential of a higher educational institution, and on the other hand, it includes the most important indicators for each of the components of the resource potential, which ensures the completeness and complexity of its assessment.

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