

**МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
КИЇВСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
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TABLE OF CONTENTS

1. GRYSHCHENKO I.	
Implementing best practices for improving energy efficiency in universities	9
2. HANUSHCHAK-YEFIMENKO L.	
Energy certification and energy audit of higher education as a methodological tool to improve the energy efficiency of the university	18
3. NIFATOVA O.	
Improving the energy efficiency of buildings by providing better protective structures based on the university's knowledge hub	26
4. SCHERBAK V.	
Using the university's energy efficiency knowledge hub for energy renovation and energy modernization of university buildings	35
5. KRAKHMALOVA N.	
Development of the innovative potential of young people on the basis of the use of the university hackathon ecosystem	45
6. GONCHARENKO I.	
Adaptation of students to research and professional activities based on the use of the university hackathon ecosystem	62
7. ARABULI S.	
Diagnosis with the hackathon ecosystem of the university of the readiness of students for research activities	77
8. VOLIANYK O.	
Smart grid energy conservation management based on the university's energy innovation hub of knowledge	90
9. DUDKO P.	
Advantages and prospects of co-branding in the ukrainian market	103
10. YATSENKO V.	
Organisational approaches to the formation of social responsibility of higher education institutions in the market of educational services	114

ЗМІСТ

1. ГРИЩЕНКО І.	
Імплементація найкращого досвіду підвищення енергоефективності університетів	9
2. ГАНУЩАК-ЄФІМЕНКО Л.	
Енергетична сертифікація та енергетичний аудит закладів вищої освіти як методичний інструментарій підвищення енергоефективності університету	18
3. НІФАТОВА О.	
Підвищення енергоефективності будівель за рахунок поліпшення якості захисних конструкцій на базі університетського хаб знань	26
4. ЩЕРБАК В.	
Використання університетського хабу знань з енергоефективності для проведення енергореконструкції та енергомодернізації будівель університету	35
5. КРАХМАЛЬОВА Н.	
Розвиток інноваційного потенціалу молоді на базі використання хакатон-екосистеми університету	45
6. ГОНЧАРЕНКО І.	
Адаптація студентської молоді до науково-дослідної та професійної діяльності на базі використання хакатон-екосистеми університету	62
7. АРАБУЛІ С.	
Діагностика за допомогою хакатон-екосистеми університету готовності студентської молоді до науково-дослідної діяльності	77
8. ВОЛЯНИК О.	
Smart grid-управління енергозбереженням на базі університетського енергоінноваційного хаба знань	90
9. ДУДКО П.	
Переваги та перспективи ко-брендінгу на ринку України	103
10. ЯЦЕНКО В.	
Організаційні підходи щодо формування соціальної відповідальності закладів вищої освіти на ринку освітніх послуг	114

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IMPLEMENTING BEST PRACTICES FOR IMPROVING ENERGY EFFICIENCY IN UNIVERSITIES

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BACKGROUND AND OBJECTIVES.

Determining the direction of energy saving development is a significant aspect and is present in the policy of rational use of energy resources of leading countries, in most cases it affects the direct consumer and producer of energy, as well as administrative measures. Implementation of best practices of energy efficiency of all types of activities is a tool to improve energy autonomy of universities in Ukraine.

METHODS. The study used: the predictive method – to determine the progress of implementation of EU Directive 2012/27/EC in Ukraine; method of comparative analysis – to determine the optimal mechanisms to promote energy efficiency in different countries and the possibility of implementing this experience to create a system of energy efficiency in Ukrainian universities.

FINDINGS. Using and expanding the experience of participation in the project to provide energy efficient and comfortable conditions of study in Ukrainian universities together with the European Investment Bank and the Nordic Environment Corporation will

allow to upgrade 200 teaching, research and support facilities in 21 universities to improve the energy efficiency of buildings and reduce operating costs of public higher education institutions; quality of teaching, learning, teaching, research and residential buildings. Implementation of such experience will improve the energy efficiency of universities, optimize mechanisms for state regulation, control and stimulation of energy efficiency; solve problems and expand the power of executive authorities and local governments, energy autonomy of universities.

CONCLUSION. The analysis of the successes and difficulties of higher professional education for people with disabilities shows that there is an objective need to consolidate the efforts of the higher education community with regional public organizations, executive authorities, regional and city institutions of health, education and social protection to support young people with disabilities.

KEYWORDS: energy efficiency; higher education institutions; universities; energy autonomy.

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ІМПЛЕМЕНТАЦІЯ НАЙКРАЩОГО ДОСВІДУ ПІДВИЩЕННЯ ЕНЕРГОЕФЕКТИВНОСТІ УНІВЕРСИТЕТІВ

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ПОСТАНОВКА ПРОБЛЕМИ ТА ЗАВДАННЯ.

Визначення напрямку розвитку енергозбереження є значним аспектом у політиці раціонального використання енергетичних ресурсів провідних країн. У більшості випадків це стосується як безпосереднього споживача та виробника енергії, так і заходів адміністративного впливу. Імплементация передового досвіду енергоефективності всіх видів діяльності є інструментом підвищення енергоавтономності університетів України.

МЕТОДИ. У дослідженні було використано: прогнозний метод – для визначення прогресу імплементации Директиви ЄС 2012/27/ЄС в Україні; метод порівняльного аналізу – для визначення оптимальних механізмів стимулювання енергозбереження у різних країнах та можливості імплементации цього досвіду для створення системи енергоефективності в українських університетах.

РЕЗУЛЬТАТИ. Врахування споживання енергоресурсів в українських університетах є обов'язковою умовою успішного впровадження реформи енергоефективності. Дані з урахуванням обліку енергії є базою реалізації енергоаудиту, впровадження систем енергоменеджменту, розробки проектів енергоефективності, аналізу

результатів як окремих проектів, і реформи загалом. Також облік енергії створює стимули для ключових суб'єктів до економного та ефективного споживання, транспортування та виробництва енергії.

ВИСНОВКИ. Використання та розширення досвіду участі у проекті забезпечення енергозберігаючих та комфортних умов навчання в університетах України спільно з Європейським інвестиційним банком та Північною екологічною корпорацією дозволить оновити 200 навчальних, дослідницьких та допоміжних споруд у 21 університеті для покращення енергоефективності будівель та зменшення експлуатаційних витрат державних установ; якості викладання, навчання, навчальних, науково-дослідних та житлових будівель. Імплементация такого досвіду дозволить підвищити енергоефективність університетів, оптимізувати механізми державного регулювання, контролю та стимулювання енергоефективності; вирішити завдання та розширити повноваження органів виконавчої влади та органів місцевого самоврядування, енергоавтономію університетів.

КЛЮЧОВІ СЛОВА: енергоефективність; вищі навчальні заклади; університети; енергоавтономія.

INTRODUCTION.

Energy efficiency and energy saving are among the five strategic priorities of the country's economic modernization (Di Stefano, 2000). Ukraine has undertaken a number of international obligations to implement energy efficiency reforms by signing the Association Agreement with the European Union (EU), becoming a member of the Energy Community and joining the concept and goals of sustainable development of the United Nations (UN) (Gryshchenko et al., 2017). The basis for the creation of the energy efficiency system is the transposition of EU Directives, in particular Directive 2012/27/EC and Directive 2010/31/EC (Kaplun and Shcherbak, 2016). In order to achieve the maximum effect of the reform in each area of energy efficiency (buildings, transport, industry and energy supply) the preconditions for effective relations in the industry must be created, the development and adoption of legislation (Liu et al., 2019), tools and support mechanisms must be created. Large-scale implementation of energy efficiency requires not only technological, organizational and financial components of project implementation (Shaposhnikova, Shimov, 2016), but also a balanced and transparent system of relations between the key actors of the energy market (Shcherbak et al., 2019). Consequently, it is critical to ensure commercial accounting, modern energy management systems, professional market of energy auditors and communication campaigns to promote energy efficiency (Vieira et al., 2020).

The purpose of the study is to propose a mechanism for implementing best practices to improve the energy efficiency of universities. The study was conducted in 2021 on the basis of data from Kyiv National University of Technologies and Design (KNUTD).

RESULTS AND DISCUSSION.

One of the weaknesses of the Ukrainian energy sector is an underdeveloped industry of energy saving technologies and insufficient demand for these technologies, energy saving has not yet become a norm of life. Due to high electricity prices, the population of most western countries has a higher economic motivation to save energy resources than the population of Ukraine. Public policies of foreign countries apply quite a large list of economic incentives for their population (Nikolaieva, 2018). Some examples are presented in Table 1.

Currently, Ukraine is taking actions to organize cooperation with foreign countries in the field of energy efficiency. The key areas of cooperation between Ukraine and the EU in the field of energy efficiency can be (On energy saving: Law of Ukraine, 2021): the promotion of measures to ensure a favorable investment environment for cooperation between Ukraine and the EU in the field of energy efficiency; identification of best international practices in energy conservation and energy efficiency; improvement of training in energy conservation and energy efficiency; the selection, launch and maintenance of

specific energy efficiency projects; work of Ukraine and the EU in the field of synchronized. To date, the following results have been achieved by implementing the state program "Energy saving and energy efficiency for the period up to 2030": preparation of a regulatory framework in the field of energy efficiency; creation and launch of a system of state support measures for energy saving and energy efficiency; pilot training courses for state and municipal officials on energy management (Shcherbak et al., 2019). As foreign experience shows, in order to achieve the national goal to improve energy saving and energy efficiency, one of the priority areas should be the formation of a lean energy efficiency model.

Table 1

**Analysis of incentive mechanisms for energy saving
in different countries and their results**

Country	Incentive mechanism	Result
Denmark	Centralization of heat supply systems	Primary fuel costs in the country have halved
	State subsidies in the amount of 30% of the cost of the construction of solar collector systems, installation of wind turbines and biomass boilers	Increased demand for renewable energy sources (RES)
Germany	When installing a wind turbine the owner receives from the state treasury 5 thousand euros.	
	Preferential crediting for construction or implementation of RES. The grid company is obliged by law to accept all energy generated by RES	
	Full or partial tax exemption for manufacturers of energy efficient technologies and equipment	Low cost of energy-efficient products
	For owners of dwelling houses who are planning to reconstruct their houses in order to increase their heating and technical characteristics, the tax burden is reduced by 20%.	Active participation of the private sector of economy in implementation of energy saving measures
	When installing a meter, the consumer is entitled to compensation from the budget in the amount of 50% of the costs actually incurred for the installation of the meter	
France	Tax deductions of 40% apply to owners who insulate houses commissioned before 1977	
	The cost of purchasing energy efficient equipment is tax deductible for citizens	High demand for energy efficient products
	The more efficient the electrical equipment is, the lower the electricity bill	
USA	Preferential energy bill rates for energy efficient buildings	Incentives to invest into building of energy efficient houses
	State subsidies of \$50 to \$200 when purchasing new, more energy-efficient appliances	Population switching to more energy efficient appliances
Taiwan	Government low-interest loans for the purchase of energy-efficient equipment	

End of Table 1

Country	Incentive mechanism	Result
Switzerland	All developers who decide to build a "passive house" (no heating required or low energy consumption) receive a government subsidy of €50,000	Decommissioning of existing nuclear power plants in the country
Japan	Government pays homeowners one-third of the cost of installing solar panels	Active transition of the private sector to solar energy
Brazil	Government subsidies for producers of sugar cane used to make biofuel (ethanol) for cars	The share of ethanol in total automobile fuel exceeds 50%
Ukraine	There are no direct incentive mechanisms. The state provides subsidies to regional budgets for co-financing of energy saving measures, but the implementation mechanism of this program is still under development	

Despite the fact that the draft law "On Energy Efficiency" has not yet received the status of law, the introduction of Directive 2012/27/EC has already made significant progress. For example, key legislation has been adopted to ensure 100% commercial metering of energy consumption, the creation of an energy audit market, and the creation of an Energy Efficiency Fund to support the population in implementing energy efficiency measures in homes (Figure 1).

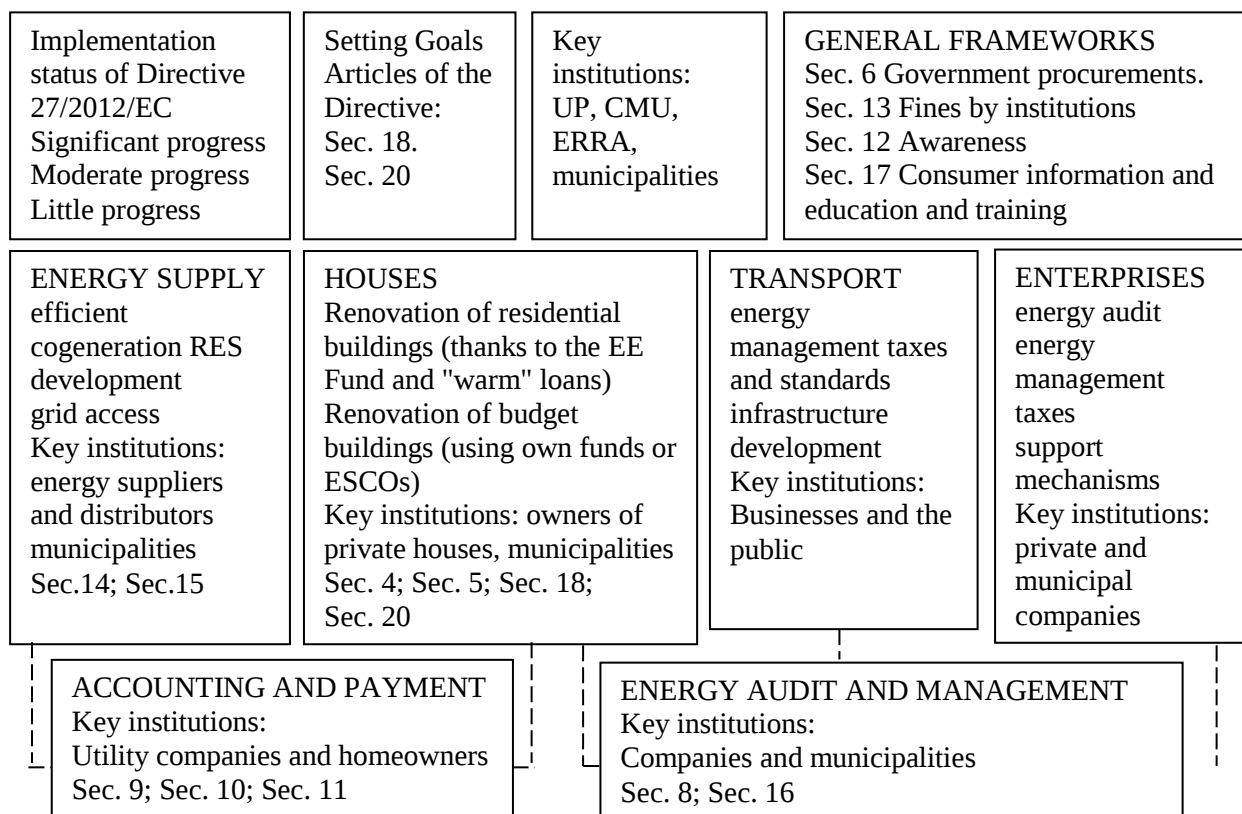


Fig. 1. Progress in the implementation of the EU Directive 2012/27/EC in Ukraine

Currently, the development of national educational standards in the energy sector is underway, competence centers are created on the basis of higher education institutions to carry out information and analytical and methodological work among students in the field of energy efficiency. Universities have responded most actively to the implementation of energy conservation and energy efficiency programs.

Many universities in the country held events aimed at energy saving. The European Investment Bank (EIB) provided a loan of around EUR 49 million for the energy efficiency of buildings of six Ukrainian universities within the framework of the Higher Education of Ukraine project. In addition, the universities will receive a EUR 10 million grant from the Eastern Europe Energy Efficiency and Environment Partnership (E5P). This project envisages the comprehensive thermo-modernization of institutions of higher education. Twenty higher education institutions will take part in two phases of the project. In the first stage, it will be the Vinnitsa National Technical University, National Technical University "Kharkov Polytechnic Institute", National University "Lviv Polytechnic", National University "Poltava Polytechnic named after Yuri Kondratyuk", National University "Chernihiv Polytechnic", Sumy State University. Work on thermo-modernization of the first six universities must begin in the autumn of 2022. Then they will be joined by another eight universities, which have won the right to take part in the second stage of the project on a competitive basis. Participation in this project will make it possible to reduce the cost of conducting mandatory energy audits and to perform them without outsourcing (On energy saving: Law of Ukraine, 2021). Universities, carrying out energy saving measures, should legally and reasonably receive tax, tariff and other benefits, which are very popular in foreign countries. After reviewing in detail the measures of energy saving policies of foreign countries there are many examples of incentives: state subsidies and soft loans for projects to implement energy saving technologies, low tariffs for energy efficient equipment and buildings modernized to save energy, and much more. This is when a high-quality energy audit will become profitable, and it will cease to be an incomprehensible mandatory procedure. After all, energy audit is a key tool for reducing the cost of consumed fuel and energy resources, which is very important for the economy of our country.

Understanding the inevitability of economic growth and, consequently, the inevitable growth of fuel and energy consumption and increased energy production, the international community has developed a number of new energy policy priorities, guiding the further development of energy in accordance with the principles of sustainable environmentally sound development. Energy policy should be based on the following three pillars: energy saving; energy efficiency; environmental safety.

The following examples of development and implementation of the energy efficiency projects are the most significant from the point of view of experience borrowing. NTU Ukraine "Kyiv Polytechnic Institute" has conducted energy audits of most academic buildings and dormitories. In most buildings of NTUU "KPI" the automatic accounting of electricity in real time is implemented (consumption is monitored hourly with the construction of graphs of active and reactive capacities). All university buildings are equipped with heat and water metering. Most buildings have automatic control of heating water supply. NTUU KPI developed a model program for MESU to reduce energy consumption by educational institutions and educational institutions subordinate to the Ministry of Education, which is funded from the state budget for 10–14 academic years, and methods of their examination.

Since 2004 the Energy Management Service of NTUU KPI was established, which is subordinate to the Vice-Rector for administrative work. The main activity is to calculate the limits of electricity, heat and water consumption, monitoring energy costs, developing energy efficiency program of the university, providing recommendations to units to improve energy efficiency, raising awareness of the university community on energy conservation, energy efficiency rating of units, holding the week. University energy conservation tips, conducting energy audits of university facilities. In order to visualize the real picture of the energy consumption of buildings and attract the attention of the university community, the relevant energy certificates are produced using the DISPLAY software. This became possible after signing a Charter with the European organization Energy Cite. The project of modernization of the lighting system of classrooms of academic buildings with the use of LED light sources was realized. At NTUU KPI IEE (building 22) a functioning system of energy supply based on a virtual station using solar, wind and biomass energy, which is monitored through a single operator center located in the same building.

CONCLUSION.

Development and implementation of energy-saving technologies should be based on a reasonable combination of requirements and regulations, including prosecution for violation of established norms, on the one hand, and economic incentives, on the other hand. Based on the experience of leading foreign countries, it should also be noted that the efficient development of energy efficiency cannot be achieved only by administrative measures and equipment upgrades, it is also necessary to develop the industry of energy-saving technologies, which is still not given due attention in Ukraine. The proposed mechanism is based on the best practices of energy efficiency in universities. It is based on the use of best practices of leading universities in Ukraine and represents a comprehensive integration of energy efficiency projects.

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ABBREVIATIONS:

%	Percentage
€	Euro
CMU	Cabinet of Ministers of Ukraine
EIB	European Investment Bank
ERRA	Energy Regulators Regional Association
EU	European Union
Fig.	Figures
HEI	higher education institution
IEE	Institute of Energy Saving and Energy Management
KNUTD	Kyiv National University of Technology and Design
LED	LED luminaires
MESU	Ministry of Education and Science of Ukraine
NTUU "KPI"	National Technical University of Ukraine "Kyiv Polytechnic Institute"
RES	Renewable energy sources
Sec.	Sector
UN	United Nations
UP	Ukrainian Parliament

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ENERGY CERTIFICATION AND ENERGY AUDIT OF HIGHER EDUCATION AS A METHODOLOGICAL TOOL TO IMPROVE THE ENERGY EFFICIENCY OF THE UNIVERSITY

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BACKGROUND AND OBJECTIVES. Improving the energy performance of buildings is one of the least expensive ways to reduce energy consumption and greenhouse gas emissions. Building energy performance certification increases public knowledge about energy conservation and allows consumers and other decision makers to compare buildings based on their lifetime performance. In addition, energy performance certifications are an incentive for owners to improve the efficiency of existing buildings.

METHODS. It is proposed to use in the process of energy certification and energy audit of university buildings collection and evaluation of basic information (including information about local climate, method of use, value of thermal conductivity coefficient and building envelope area, orientation) to determine the level of energy efficiency of the building on a generally accepted scale. In the Certificate of energy efficiency to take into account the calculated results from the assessment of the energy performance of the building.

FINDINGS. It is suggested that the results of the energy certification of university buildings be presented in a simple, clear form, to ensure clarity, ease of use and comparability. For the energy certification of university buildings, a comparative labeling from A to G is proposed for use. The scale, on which the current national building standard is at "C," provides ample room for improving the rating of both new and existing buildings. If necessary, the scale should be expanded to add a label such as A1, A2, or A+, A++ when it comes to high-performance buildings.

CONCLUSION. Accurate and reliable energy performance certification is a necessary foundation that will help ensure consumer confidence and the success of the certification program. The certification program must be clearly coordinated to ensure a smooth transition of the construction industry to the new rules.

KEYWORDS: energy certification; energy audits; universities; energy efficiency.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
10	0	1

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ЕНЕРГЕТИЧНА СЕРТИФІКАЦІЯ ТА ЕНЕРГЕТИЧНИЙ АУДИТ ЗАКЛАДІВ ВИЩОЇ ОСВІТИ ЯК МЕТОДИЧНИЙ ІНСТРУМЕНТАРІЙ ПІДВИЩЕННЯ ЕНЕРГОЕФЕКТИВНОСТІ УНІВЕРСИТЕТУ

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ПОСТАНОВКА ПРОБЛЕМИ ТА РЕЗУЛЬТАТИ. ЗАВДАННЯ.

Підвищення енергетичної ефективності будівель – це один із найменш витратних способів скорочення енергоспоживання та викидів парникових газів. Сертифікація енергетичних характеристик будівель підвищує рівень знань у суспільстві про енергозбереження та дозволяє споживачам та іншим особам, які приймають рішення, порівнювати будівлі, виходячи з їхньої ефективності за період експлуатації. Крім того, свідоцтва про енергоефективність – це стимул для власників підвищити ефективність існуючих будівель.

МЕТОДИ.

Запропоновано використовувати в процесі енергосертифікації та енергоаудиту будівель університету збір та оцінку основної інформації (у тому числі інформації про місцевий клімат, спосіб використання, значення коефіцієнта теплопровідності та площу оболонки будівлі, орієнтації) для визначення рівня енергетичної ефективності будівлі за загальноприйнятою шкалою. У Свідоцтві про енергетичну ефективність враховувати обчислені результати за підсумками оцінки енергетичних характеристик будівлі.

Запропоновано результати енергосертифікації будівель представляти у простій, чіткій формі для забезпечення ясності, простоти у використанні та можливості порівняння. Для енергосертифікації університетських будівель запропоновано до використання порівняльне маркування від А до G. Шкала, на якій сучасний національний будівельний стандарт знаходиться на позначці "C", дає достатньо місця для покращення рейтингу як нових, так і існуючих будівель. У разі потреби шкалу слід розширити і додати таке маркування як A1, A2 або A+, A++, якщо йдеться про вискоефективні будівлі.

ВИСНОВКИ. Точність та надійність свідчень про енергетичну ефективність – це необхідна основа, яка допоможе гарантувати довіру споживачів та успіх програми сертифікації. Необхідно чітко координувати виконання програми сертифікації, що дозволить забезпечити плавний перехід будівельної галузі до нових правил.

Ключові слова: енергосертифікація; енергоаудит; університети; енергетична ефективність.

INTRODUCTION.

In the European Community, the construction sector consumes more than 40% of the energy given, and this figure is constantly growing. This trend will definitely lead to an increase in energy consumption and, as a consequence, an increase in carbon dioxide emissions. Since the oil crisis in the late 1970s, various countries have adopted different strategies to improve the energy efficiency of the national building stock. The Directive on the Energy Performance of Buildings, adopted in 2002 and finalized in 2010 (2010/31/EC), is a European Commission directive that obliges EU member states to set minimum energy performance standards for new and renovated buildings (Di Stefano, 2000). In addition, the directive requires each member state to implement energy performance certificates for new and existing buildings (Gryshchenko et al., 2017).

Energy performance certification of buildings is considered an important tool that will help to attract investments to improve the energy performance of buildings and increase consumer awareness of the energy saving potential of buildings (Kaplun and Shcherbak, 2016). Certification was created as a market-based tool that will help improve the energy efficiency of buildings, repairs, and utilities (Liu et al., 2019). Ideally, it is an easy way for consumers to compare and evaluate energy efficiency investments in buildings in terms of energy consumption in the long term. Implementation of the international standard ISO 50001 is necessary for all industries, educational institutions, trade, hotels, etc. (Shaposhnikova and Shimov, 2016).

Implementing an energy management system allows universities to improve the efficiency of their educational activities and to benefit greatly from the optimal use of their energy resources (Shcherbak et al., 2019). Inefficient energy processes can be seen at almost every enterprise, and it can be observed in the irrational use of energy resources, it can be the lack of control over the operation of compressors, engines, compressed air leaks, lack of motion sensors, the use of energy-intensive lighting and heating, it all leads to significant costs, which are transferred to the services provided (Vieira et al., 2020).

Implementation of energy management system provides opportunities for the university to solve all these problems (Xing et al., 2019). The main requirements for organizations in the implementation of ISO 50001: development of effective energy use policy, development of goals and objectives in accordance with the established policy, set the rules of understanding how to better use energy, regular measurement of results, analysis of the current energy management system (Nikolaieva, 2018). The aim of the article is to develop theoretical and methodological provisions for the formation of energy certification system and energy audit as a methodological tool to improve the energy efficiency of the university. Methodological approach to

energy certification and energy audit was carried out on the basis of the survey of buildings of Kyiv National University of Technologies and Design (KNUTD) in 2021.

MATERIALS AND METHODS.

According to Article 3 of the 2002 ECT, each member state has to adopt a calculation methodology for the energy performance of buildings, based on certain rules (On energy saving: Law of Ukraine, 2021).

The methodology for the calculation of the energy performance of buildings shall include the following:

(a) Thermal characteristics of buildings (envelope and interior partitions, etc.). These characteristics may also include air tightness;

b) Heating system and hot water supply, including their insulation parameters;

(c) Installation for air conditioning;

(d) Ventilation;

(e) Integrated lighting system (mainly in the non-residential sector);

(f) Location and orientation of buildings, including outdoor climate;

(g) Passive solar systems and solar protection;

(h) Natural ventilation;

(i) Indoor climatic conditions, including design room microclimate.

Further, if necessary for the calculation, the positive effects of the following aspects must be taken into account: a) active solar systems and other heating and power systems based on renewable energy sources; b) electricity produced by CHP; c) centralized heating and cooling systems; d) natural lighting.

The calculation methodology shall take into account the standards or rules applicable in EU member states according to their legislation. The energy performance of buildings must be presented transparently and may include an indicator of CO₂ emissions. The European Community has prepared corresponding European EN standards, which must be adopted in the member states. These are, for example, simplified calculation formulas that member states can approve and apply at their discretion. Some member countries have chosen the option of integrating the calculation methodology into software or spreadsheets. In many cases, independent software developers have created licensed computer applications or software modules that conform to the calculation methodology of a particular member state. Most often, such applications are tested and approved by government agencies with expertise in building energy systems.

RESULTS AND DISCUSSION.

The Directive on the Energy Performance of Buildings, adopted in 2002 and revised in 2010 (2010/31/EC), is a European Commission directive

requiring member states to set minimum energy performance standards for new and renovated buildings. In addition, the directive requires each member state to implement energy performance certificates for buildings. The directive requires the calculation of the energy performance of buildings on the basis of a methodology that may vary regionally, but includes, in addition to thermal insulation, other factors of increasing importance, such as heating and air conditioning installations, the use of renewable energy sources and building design. Furthermore, according to the Directive, each Member State must ensure a uniform approach to this process, which will be carried out by qualified accredited experts whose independence must be guaranteed on the basis of objective criteria. The aim of this approach is to ensure a common "rules of the game" in terms of the Member States' attempts to ensure energy savings in the building sector and to help them ensure transparency of the energy performance of buildings to potential owners or consumers in the European real estate market.

Energy performance certification is an audit carried out by a qualified professional, which results in a decision. The building is assigned one of seven energy efficiency levels, and the results are necessarily entered in the Registry. Energy certificate – an electronic document in the prescribed form, which specifies the indicators and class of the building, the actual and design characteristics of the building envelope and engineering systems. Energy certificate - the result of energy audit containing a detailed calculation, with specific figures on the cost and payback. Certification is mandatory for all public authorities premises. The law of obligatory certification of buildings defines that the energy certificate serves as a tool for assessing energy efficiency and shows how many resources the building uses and the potential to minimize them. Rational indicators of consumption of thermal and electrical energy of the object in Ukraine is used the distribution into classes (Table 1).

Table 1

**Indicators of heat and electricity consumption
of the facility in Ukraine by class**

Class	Residential Buildings		Public buildings		Hotels		Educational institutions	Kindergarten s
	Number of floors		Number of floors		Number of floors			
	1–3	4 and up	1–3	4 and up	1–3	4 and up		
A	<66	<44	<[30]	<[21]	<60	<39	<[17]	<[28]
B	<119	<79	<[54]	<[38]	<109	<70	<[30]	<[51]
C	<132	<87	<[60]	<[43]	<121	<78	<[33]	<[56]
D	<165	<109	<[74]	<[53]	<151	<97	<[42]	<[70]
E	<198	<131	<[89]	<[64]	<181	<116	<[50]	<[85]
F	≤231	≤153	≤[104]	≤[75]	≤211	≤136	≤[58]	≤[99]
G	>231	>153	>[104]	>[75]	>211	>136	>[58]	>[99]

The energy efficiency label classifies buildings according to their energy consumption on a scale from A (low energy consumption, high energy efficiency) to G (high energy consumption, low energy efficiency).

Energy efficiency certificates can be divided into two categories based on the method of calculation: certificates based on calculated need and certificates based on measured consumption. That is, when certifying university buildings, one can choose between "demand" and "consumption" for all existing buildings since heating and hot water billing is based on consumption. To match the data obtained by calculating demand, the impact of weather conditions over the period of data collection (at least 3 years) should be adjusted to account for the climate factor. In addition, a single "reference climate" (Würzburg climate) should be used for certification and auditing, and the energy consumption data for heating should also be recalculated using the parameters of this climate.

The comprehensive calculation method is described in DIN V18599, which is in accordance with the standards of the European Committee for Standardization applied to prove compliance with the requirements of the Energy Conservation Ordinance and gives energy efficiency values for inclusion in Energy Performance Certificates drawn up on the basis of energy demand.

For the certification and audit it is necessary to consider the quality of the software, i.e. the correct transfer of the technical rules to the software, which is an important step in terms of the quality of the results.

CONCLUSION.

The proposed calculation methodology includes too many scenarios in the normal course of events (spare values), and is therefore too far from reality. Therefore, the problem arose of using a more reliable calculation methodology to determine the energy efficiency level of a university building. To solve this problem, consideration should be given to expanding the number of data to be entered into the program from 30 to 60 and reducing the number of parameters. The values of thermal and technical characteristics of the building envelope and individual elements, as well as the efficiency of the heating, cooling, ventilation and hot water supply systems should be determined according to the operational needs of each particular university building.

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The author is grateful to the heads of higher educational institutions for their assistance in conducting this research.

ABBREVIATIONS:

%	Percentage
€	Euro
CMU	Cabinet of Ministers of Ukraine
EIB	European Investment Bank
ERRA	Energy Regulators Regional Association
EU	European Union

<i>Fig.</i>	Figures
<i>HEI</i>	higher education institution
<i>IEE</i>	Institute of Energy Saving and Energy Management
<i>KNUTD</i>	Kyiv National University of Technology and Design
<i>MESU</i>	Ministry of Education and Science of Ukraine
<i>NTUU "KPI"</i>	National Technical University of Ukraine "Kyiv Polytechnic Institute"
<i>RES</i>	Renewable energy sources
<i>Sec.</i>	Sector
<i>UN</i>	United Nations
<i>UP</i>	Ukrainian Parliament

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IMPROVING THE ENERGY EFFICIENCY OF BUILDINGS BY PROVIDING BETTER PROTECTIVE STRUCTURES BASED ON THE UNIVERSITY'S KNOWLEDGE HUB

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BACKGROUND AND OBJECTIVES.

Modern university buildings use a large number of resources, such as heat, cold and hot water, as well as electricity, which is the main consumed energy resource and is used for lighting, office equipment, ventilation and air conditioning systems. In order to improve the energy efficiency of university buildings, it is necessary to carry out heat and energy modernization of internal and external envelopes, which will allow for internal billing and qualitative analysis of consumption, which contribute to prompt decision-making on heat and energy modernization of the premises.

METHODS. To assess the potential for improving the energy efficiency of buildings by improving the quality of protective structures, methods for assessing the temperature and humidity conditions of multilayered enclosing structures in a wide range of humidity under stationary boundary conditions were developed on the basis of the University Hub of Knowledge.

FINDINGS. On the basis of the University Hub of Knowledge, Kyiv National University of Technologies and Design, the moisture content profile was

calculated for the general estimation of the moisture condition for building No. 4, the planes of the highest moisture content were determined to find the most dangerous, from the moisture condition point of view, section of the structure, the calculation of the enclosing structure modernization according to the maximum allowable moisture condition for the analysis of moisture accumulation in the coldest month of the year was made.

CONCLUSION. The advantage of the proposed method of increasing the energy efficiency of buildings by improving the quality of protective structures based on the University Hub of Knowledge is the possibility of calculation in a wide range of moisture content of materials, including supersorption moisture zone, as well as applicability to structures with multizone condensation of moisture. The clarity and simplicity of the proposed method makes it available for the practical implementation of energy efficiency improvements in all university buildings.

KEYWORDS: HUB of knowledge on energy efficiency; university; building envelopes; thermal energy modernization.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
10	3	1

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ПІДВИЩЕННЯ ЕНЕРГОЕФЕКТИВНОСТІ БУДІВЕЛЬ ЗА РАХУНОК ПОЛІПШЕННЯ ЯКОСТІ ЗАХИСНИХ КОНСТРУКЦІЙ НА БАЗІ УНІВЕРСИТЕТСЬКОГО ХАБ ЗНАНЬ

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та дизайну, Україна

ПОСТАНОВКА ПРОБЛЕМИ ТА ЗАВДАННЯ. Сучасні університетські будівлі використовують велику кількість ресурсів, таких як тепло, холодна і гаряча вода, а також електрична енергія, яка є основним енергоресурсом, що витрачається, і використовується на освітлення, роботу оргтехніки, систем вентиляції та кондиціювання. Для підвищення енергоефективності університетських будівель необхідне проведення теплоенерго модернізації внутрішніх та зовнішніх огорож, що дозволить проводити внутрішній білінг та якісний аналіз споживання, які сприяють оперативному прийняттю рішень щодо теплоенерго модернізації приміщень.

МЕТОДИ. Для оцінки потенціалу підвищення енергоефективності будівель за рахунок покращення якості захисних конструкцій на базі університетського Хаб знань були розроблені методи оцінки температурно-вологісного режиму багатопарових конструкцій, що захищають, у широкому діапазоні вологості за стаціонарних граничних умов.

РЕЗУЛЬТАТИ. На базі університетського Хаб знань Київського національного університету технологій та дизайну виконано

розрахунок профілю вмісту вологи для загальної оцінки вологого режиму для корпусу №4, визначено площини найбільшого зволоження для виявлення найбільш небезпечного, з погляду вологого режиму, перетину конструкції, виконано розрахунок модернізації огорожувальних конструкцій по гранично допустимого стану зволоження для аналізу накопичення вологи в найхолодніший місяць року.

ВИСНОВКИ.

Перевагою запропонованого методу підвищення енергоефективності будівель за рахунок покращення якості захисних конструкцій на базі університетського Хаб знань є можливість розрахунку в широкому діапазоні вологості матеріалів, включаючи надсорбційну зону зволоження, а також застосування до конструкцій з мультизональною конденсацією вологи. Наочність та простота запропонованого методу робить його доступним для практичної реалізації підвищення енергоефективності всіх будівель університету.

КЛЮЧОВІ СЛОВА: ХАБ знань з енергоефективності; університет; огорожувальні конструкції; теплоенерго модернізація.

INTRODUCTION.

The reduction of energy natural reserves acutely puts the problem of energy conservation and energy efficiency of buildings (Di Stefano, 2000). From the point of view of I. Gryshchenko, V. Shcherbak, O. Shevchenko solution of this problem is closely connected with increasing requirements for the quality of building design, since design errors lead to a decrease in the thermal protection properties of building envelopes and increase the energy costs of building operation (Gryshchenko et al., 2017).

The choice of a rational design solution at the design stage of technological modernization of operating university buildings according to V. Kaplun, V. Shcherbak is connected with the problem of research of heat and mass exchange processes (Kaplun and Shcherbak, 2016), forecast of temperature and moisture conditions of enclosing structures and increasing the accuracy of thermal calculations (Liu et al., 2019), since temperature and moisture conditions of enclosures directly affect the microclimate of rooms, thermal protection properties, reliability and environmental safety (Shaposhnikova and Shimov, 2016).

The most difficult, from the point of view of V. Scherbak, L. Ganushchak-Efimenko, O. Nifatov, P. Dudko, N., Savchuk, I. Solonenchuk, is to predict the temperature and humidity conditions in thermally heterogeneous sections of fences (marginal zones) in which the heat and moisture transfer occurs in two and three-dimensional schemes (Shcherbak et al., 2019). More than 40% of the total heat loss of the enclosure is noted through the peripheral zones according to E. Vieira, B. dos Santos, N. Zampieri, S. da Costa, E.de Lima (Vieira et al., 2020). Moisture localization in these areas above permissible values (Xing et al., 2019) leads to a deterioration of the moisture regime, reducing the thermal protection and life of the entire building. At the same time, the absence of modern methods for calculating temperature and moisture conditions in three-dimensional areas of enclosing structures, convenient for practical application, makes it difficult to assess the impact of edge zones on the thermal protection and energy efficiency of operating university buildings (Nikolayeva, 2018).

Thus, the problem of energy saving and improving the energy efficiency of operating university buildings leads to the need to study the processes of heat and mass transfer and the development of methods for calculating the temperature and humidity conditions of the enclosing structures (On energy saving: Law of Ukraine, 2021). This determines the relevance of the problem of improving the thermal protection and energy efficiency of operating university buildings in the absence of scientific and methodological apparatus for the formation of requirements to enclosure structures, taking into account the characteristics of temperature-moisture regime in the marginal zones of enclosures on the basis of the university Hub of Knowledge.

The purpose of this paper is to substantiate the necessity of using the university Hub of Knowledge to form requirements for fencing constructions taking into account the peculiarities of temperature and humidity conditions of operating university buildings. The research of the condition of the enclosing structures of operating university buildings of Kyiv National University of Technology and Design was carried out in 2021.

MATERIALS AND METHODS

Calculation of the moisture content profile. The basis of this method are linear distributions of temperature $t(x)$ and absolute moisture potential $\theta(x)$ in the structure (1–2):

$$t(x) = t_{int} - \frac{t_{int} - t_{ext}}{R_h^{con}} R_h(x); \quad (1)$$

$$\theta(x) = \theta_{int} - \frac{\theta_{int} - \theta_{ext}}{R_m^{con}} R_m(x), \quad (2)$$

where $R_h(x)$, $R_m(x)$ – heat and moisture transfer resistance to the section under consideration x ;

R_h^{con} , R_m^{con} – total heat and moisture transfer resistance of the enclosure, respectively.

Using the $t(x)$ distribution, one determines the values of the maximum sorption potential of moisture, the distribution of the relative moisture potential, and the desired moisture content distribution over the thickness of the multilayer structure. The above method provides an overall assessment of the moisture conditions of structures. The proposed method is convenient for assessing the operational suitability of enclosures to maintain the required level of energy saving.

RESULTS AND DISCUSSION.

The executed review of methods of an estimation of energy efficiency of buildings has shown, that the specified methods do not consider influence of processes of a heat and mass exchange in marginal zones of enclosing designs on a microclimate of premises, thermal protective properties and energy efficiency of buildings in view of absence of a method of calculation of a temperature-humidity mode in three-dimensional areas of external enclosures. Meanwhile, as practice shows, there is often a deterioration of temperature and humidity conditions in the marginal areas of the enclosing structures, which leads to a decrease in the thermal protection of the entire building. The specified method makes it possible to determine the most dangerous section of the structure with regard to the moisture regime without constructing moisture content profiles. In contrast to the existing calculation methods, the developed method enables to estimate the protection of envelop structures against

overmoistening in a wide range of moisture content, gives a quantitative characteristic of the degree of material overmoistening and is applicable to calculation of enclosures with multizone moisture condensation.

The proposed mathematical model is implemented in the computer program "Joint Moisture and Heat Transfer" in the visual object-oriented programming system Delphi 3–7. The main advantages of the model and the computer program are the following: the use of the scale of non-isothermal absolute potential of humidity that allows to simplify the mathematical model of heat and moisture transfer and makes it possible to calculate in a wide range of material humidity; the possibility of studying dynamics of temperature and humidity conditions of enclosures of complex geometric structure under variable climate and microclimate influences; applicability to studying heat and humidity processes of various intensities of the climate and microclimate of rooms.

Application of the computer program is illustrated by an example of calculation of the temperature-humidity regime of a fragment of a three-layer wall panel with a keyed connection in an annual cycle (Fig. 1, 2).

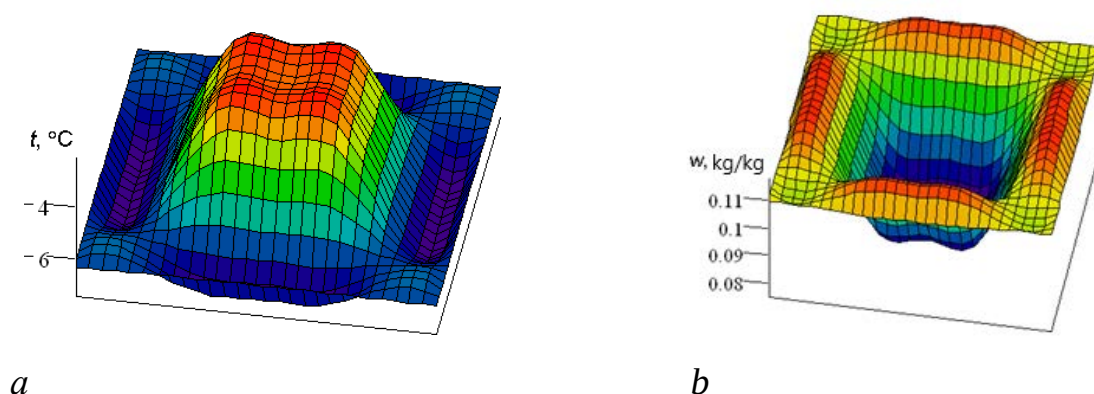


Fig. 1. Fields of temperature (a) and moisture content (b) at the junction of the insulation with the outer protective and finishing layer (expanded clay aggregate concrete) in mid-January

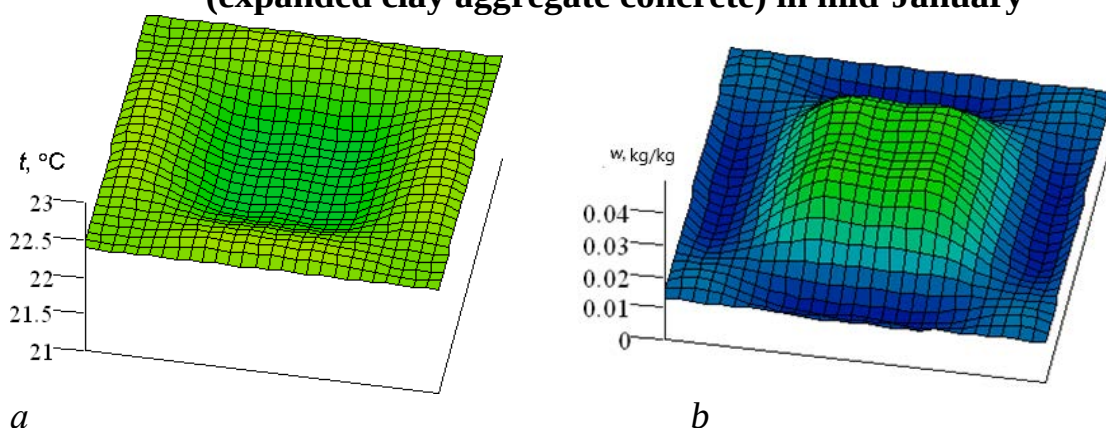


Fig. 2. Fields of temperature (a) and moisture content (b) at the junction of the insulation with the outer protective and finishing layer (on the insulation) in mid-July

The presence of extremes in temperature and moisture content (Fig. 1) is physically conditioned by the heterogeneity of the considered fragment of the structure and the non-linearity of the process of moisture heat transfer. Verification of the developed calculation method by different methods: by analytical solution and sequence of spatial and temporal grids, by different mathematical models of moisture and heat transfer, by results of field studies of indoor microclimate parameters, temperature-moisture regime and thermal protection properties of enclosing structures based on the university's Hub of Knowledge. Verification of the calculation method developed on the basis of the University Hub of Knowledge confirms its reliability, which allows you to use this method in the practice of operation and insulation of buildings KNUTD. Numerical values of indicators confirming the reliability of the above calculations.

On the basis of the results of thermal imaging survey (Fig. 3), obtained on the basis of the University Hub of KNUTD knowledge, the assessment of the influence of the marginal zones of the enclosing structures on the temperature and humidity conditions of the premises (Table 1) was carried out.

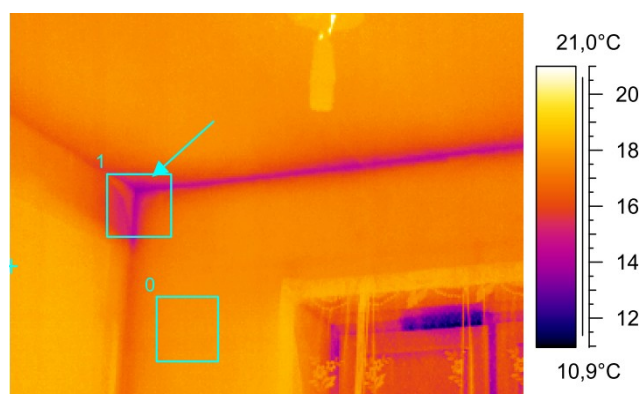


Fig. 3. Thermogram on the inner surface of the enclosures of the auditoriums of KNUTD building #4

Table 1

Comparison of calculated and measured microclimate parameters in classrooms of KNUTD Building No. 4

Parameter	Actual (measured) value of the parameter	Calculated value of the parameter	
		excluding edge zones	including marginal zones
Resulting room temperature, °C	19	19.5	19
Temperature difference, °C, between the inside air and the inside surface of the wall	4.1	1.8	4
Minimum temperature on the inner surface of the wall, ° C	8.3	—	8.4

Table 1 shows that failure to take into account the marginal zones of enclosures in the thermal modernization of buildings overestimates the resultant room temperature by 2.6%. At the same time, not taking into account edge zones leads to underestimation of temperature difference between internal air and internal surface of the outer wall by 56%, distorts the assessment of comfortable conditions in the room and creates significant risks in assessing sanitary-hygienic requirements on the condition of inadmissibility of moisture condensation on the internal surface of the enclosures. Accounting for edge zones on the basis of the proposed method for calculating the temperature and humidity conditions allows us to achieve almost complete coincidence of the calculated and measured room microclimate parameters (Table 1), ensuring high accuracy of the research results and increasing the quality of heat and power modernization. Analysis of the results shows a local decrease in the temperature in the marginal zones of the enclosures. The resulting room temperature according to the measurements is 19 °C. The actual temperature difference between the interior air and the inner surface of the wall, reduced to design conditions, exceeds the normative value. The minimum temperature on the inner surface of the wall is lower than the dew point of the inner air, which leads to condensation in the edge zone under design conditions. Thus, the method of numerical solution of the three-dimensional problem of joint unsteady heat and moisture transfer allows predicting the temperature and humidity conditions of the enclosures in order to save energy and improve the reliability and thermal safety of the university buildings in operation.

CONCLUSION.

On the basis of the studies carried out on the basis of the university KNUTD Hub of Knowledge, a major scientific problem of improving the thermal protection and energy efficiency of operating university buildings by developing the scientific and methodological apparatus for the formation of requirements for envelope structures, taking into account the characteristics of temperature and humidity conditions in the fencing edge zones, which has important economic importance was solved.

ACKNOWLEDGEMENT.

The author is grateful to the heads of higher educational institutions for their assistance in conducting this research.

ABBREVIATIONS:

%	Percentage
Eq.	Formula of calculation
Fig.	Figures
HEI	Higher education institution
Hub	Common connection point
KNUTD	Kyiv National University of Technology and Design

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USING THE UNIVERSITY'S ENERGY EFFICIENCY KNOWLEDGE HUB FOR ENERGY RENOVATION AND ENERGY MODERNIZATION OF UNIVERSITY BUILDINGS

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BACKGROUND AND OBJECTIVES. The most important socio-economic task in the current period is to transfer Ukraine's economy to an intensive way of development in order to improve the level and quality of life of the population and solve the full range of social problems. Implementation of such a policy dictates the need to solve problems of reconstruction and modernization of buildings and structures, primarily related to the public sphere (including higher education institutions), in order to eliminate the existing inconsistency of the technical condition and functional and consumer qualities of public buildings to current standards and consumer requirements. Therefore, one of the most urgent directions of development of higher educational institutions is the task of providing effective overhaul and reconstruction of buildings, increasing their energy efficiency.

METHODS. The theoretical and methodological basis of the study were the fundamental and applied developments of leading domestic and foreign scientists in the theory and practice of management of energy modernization and energy reconstruction of buildings, increasing energy efficiency of buildings. The factual basis of research were the legislative acts of Ukraine in the field of energy efficiency, normative and methodical documents on the modernization and reconstruction of buildings, Directive 2010/31/EC in the field of energy saving. When solving specific tasks the methods of system and comparative analysis, economic-mathematical methods of efficiency evaluation of energy

reconstruction and energy modernization projects were used.

FINDINGS. The method of calculation of the reduced resistance to heat transfer of the enclosing structures and the shell of the 4th building of Kyiv National University of Technology and Design as a whole taking into account the temperature and humidity conditions in the fencing marginal zones. It is shown that in the enclosure edge zones the heat protective properties decrease resulting in a deterioration of the heat protection of the whole building. Practical recommendations for the design of fencing structures of modern buildings taking into account the temperature-moisture regime are proposed.

CONCLUSION. For the analysis of complex processes of moisture transfer in enclosures, a mathematical model based on the moisture potential is most convenient. A certain difference from the thermal potential (temperature) to the definition of the moisture potential allows to diagnose the most general assessment of the moisture regime of exterior and interior fences on the basis of HUB knowledge on energy efficiency. At use of this model it is possible to consider process of moisture exchange in a wide range of humidity and temperature taking into account movement of a moisture as a basis of carrying out energy reconstruction and energy modernization of operating buildings of the university.

KEYWORDS: Energy Efficiency Knowledge HUB; university; energy reconstruction; energy modernization.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
17	3	2

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**ВИКОРИСТАННЯ ХАБУ ЗНАНЬ З ЕНЕРГОЕФЕКТИВНОСТІ
ДЛЯ ЕНЕРГОРЕКОНСТРУКЦІЇ ТА
ЕНЕРГОМОДЕРНІЗАЦІЇ БУДІВЕЛЬ
УНІВЕРСИТЕТУ**

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ПОСТАНОВКА ПРОБЛЕМИ ТА ЗАВДАННЯ. Найважливішим соціально-економічним завданням у поточний період є переведення економіки України на інтенсивний шлях розвитку з метою підвищення рівня та якості життя населення та вирішення повного комплексу соціальних завдань. Проведення такої політики диктує необхідність вирішення проблем реконструкції та модернізації будівель та споруд, що насамперед належать до суспільної сфери (вищих навчальних закладів у тому числі), з метою ліквідації невідповідності технічного стану та функціонально-споживчих якостей громадських будівель чинним нормативам та вимогам споживачів, що має місце. Тому одним із найбільш актуальних напрямів розвитку вищих навчальних закладів є завдання забезпечення ефективного капітального ремонту та реконструкції будівель, підвищення їхньої енергоефективності.

МЕТОДИ. Теоретичною та методичною основою дослідження послужили фундаментальні та прикладні розробки провідних вітчизняних та зарубіжних науковців у галузі теорії та практики управління енергомодернізацією та енергореконструкцією будівель, підвищення енергоефективності будівель. Фактичною базою дослідження стали законодавчі акти України в галузі енергоефективності, нормативні та методичні документи з питань модернізації та реконструкції будівель, Директиви 2010/31/ЄС у сфері енергозбереження. При вирішенні конкретних завдань використовувалися методи системного та порівняльного аналізу,

економіко-математичні методи оцінки ефективності проектів енергореконструкції та енергомодернізації.

РЕЗУЛЬТАТИ. Розроблено методику розрахунку наведеного опору теплопередачі огорожувальних конструкцій та оболонки 4-го корпусу Київського національного університету технологій та дизайну загалом з урахуванням температурно-вологісного режиму у крайових зонах огорож. Показано, що в крайових зонах огорож теплозахисні властивості знижуються, що призводить до погіршення теплозахисту всієї будівлі. Запропоновано практичні рекомендації щодо проектування огорожувальних конструкцій сучасних будівель з урахуванням температурно-вологісного режиму.

ВИСНОВКИ. Для аналізу складних процесів вологопереносу в огорожах найбільш зручна математична модель, що ґрунтується на потенціалі вологості. Певна відмінність від теплового потенціалу (температури) до визначення потенціалу вологості дозволяє на базі ХАБ знань з енергоефективності діагностувати найбільш загальну оцінку вологого режиму зовнішніх та внутрішніх огорож. При використанні цієї моделі можна розглядати процес вологообміну в широкому діапазоні вологості та температури з урахуванням переміщення вологи як основу проведення енергореконструкції та енергомодернізації експлуатованих будівель університету.

КЛЮЧОВІ СЛОВА: ХАБ знань з енергоефективності; університет; енергоре-конструкція; енергомодернізація.

INTRODUCTION.

Improvement of energy efficiency is a necessary element of the growth of energy independence of the country and reduction of energy intensity of the economy (Abu-Rayash and Dincer, 2020). The energy intensity of GDP in terms of purchasing power parity in Ukraine is three times higher than in most European countries (Di Stefano, 2000). Over the past three years, significant progress has been made in the implementation of the reform (especially in the residential sector): important laws, by-laws, the process of launching the Energy Efficiency Fund, etc. has been adopted. However, most of the implementation work is still ahead (Ganushchak-Efimenko et al., 2018).

The Ukrainian energy system is characterized by high energy dependence on imported energy resources – one third of primary energy is imported. 44% of energy is lost during transformation and transportation to the final consumer (while the EU average is 32%) – with 92 million tons of primary energy supply, the final consumption is 52 million tons. The largest consumer of energy is the domestic and industrial sectors – 17.6 million tons (or ~35%) and 15.0 million tons (or ~29%), respectively. The key sources of primary energy are coal (~33%), natural gas (28%) and nuclear energy (23%) (García et al., 2021).

The urgency of improving the efficiency of reproduction of housing and public buildings is determined by the strategic orientation of the economic development of Ukraine to the formation of energy-efficient economy, both on a national scale and on the scale of individual regions and municipalities (Gryshchenko et al., 2017). In the Ukrainian housing sector and public buildings there is a significant potential to improve energy efficiency (Kaplun and Shcherbak, 2016). According to the World Bank and Ukrainian researchers overhaul and reconstruction of existing buildings can bring savings of 30–60% of the energy consumed for heating purposes, public buildings – up to 50% (Liu et al., 2019). One of the essential potentials of use of energy efficiency have university buildings, which in most cases are very worn out and have exhausted their resource (Nayak et al., 2021). Therefore, the relevance of the use of new university education on the principles of university Knowledge Hub is now particularly high (Nicola et al., 2020).

The aim of the study is to propose a methodology for energy reconstruction and energy modernization of internal and external partitions of buildings on the basis of university Hub of knowledge on energy efficiency. The study was conducted in 2021 on the basis of the Kyiv National University of Technologies and Design.

MATERIALS AND METHODS

For a building envelope consisting of m building envelopes ($m \geq 1$), the reduced heat transfer resistance is calculated by equation (1):

$$R_{he}^{des} = \frac{A_e^{sum}}{\sum_{i=1}^m \frac{n_i A_i}{R_{hi}^{des}}}, \quad (1)$$

where n_i is the coefficient taking into account the position of the i -th enclosing structure relative to the indoor and outdoor air.

Assessment of the impact of edge zones on the energy performance of buildings calculation of the energy performance of the building for the heating period using the specific energy consumption for the operation of the building during the heating period is calculated by equation (2):

$$q = q_h + q_{hw} + q_e, \quad (2)$$

where q_h , q_{hw} , q_e are respectively specific heat consumption for heating, hot water supply and electric energy (direct or reduced to heat equivalent) for the heating period.

The specific heat consumption for heating is calculated on the basis of the heat balance of the building for the heating period according to equation (3):

$$q_h = q_{tr} + q_a - \eta(q_{int} + q_s), \quad (3)$$

where q_{tr} , q_a , q_{int} , q_s are respectively specific transmission heat losses through the building envelope, specific heat losses due to air infiltration and ventilation, specific internal domestic heat losses, specific heat gains due to solar radiation;

$\eta \leq 1$ –coefficient of heat gain into the building.

The influence of the peripheral zones of the enclosing structures on the specific energy consumption is taken into account when calculating the specific transmission heat losses q_{tr} . The total transmission heat loss through the envelope is the sum of the main heat loss and the additional heat loss through all the envelope edge zones and is calculated by equation (4):

$$Q_t = \frac{0.0864 M_{ht} A}{R_h^{con}} (1 + \sum_{j=1}^l \omega_j), \quad (4)$$

where l is the number of edge zones;

$\omega_j = k_j^{ez} A_j^{ez} / A$ is the coefficient of additional heat loss through the j -th edge zone.

Equation (4) makes it possible to calculate the total heat loss of the envelope, taking into account the edge zones, and to evaluate the contribution of each edge zone to the heat loss.

For a building envelope consisting of m building envelopes ($m \geq 1$), specific transmission heat losses are calculated by equation (5):

$$q_{tr} = \frac{1}{V_h} \sum_{i=1}^m Q_{Ti}, \quad (5)$$

where Q_{Ti} is the total transmission heat loss through the i -th structure.

RESULTS AND DISCUSSION.

The developed method allows to take into account the influence of humidity on the temperature field of the structure, the non-stationarity of the temperature and humidity regime, three-dimensionality of the temperature and humidity fields, which is in the world trend with the energy saving program in the university buildings.

For widely used in practice of energy reconstruction and energy modernization of external and internal enclosures of the 4-th building of Kyiv National University of Technologies and Design (KNUTD) which contain marginal zones, there was executed the calculation of temperature and humidity conditions by the computer program "SOVT-3".

Based on the results of the calculation (Fig. 1–3), the effect of the marginal zones on the thermal protection properties of the enclosing structures was assessed.

The study shows that for all types of considered structures in the marginal zones the localization of temperature and moisture content with the formation of complex marginal effects due to the joint effect of heat and moisture transfer processes is noted. Deterioration of the temperature and moisture conditions in the marginal zones leads to a decrease in the thermal protection properties of structures. The maximum decrease in thermal protection properties (up to 47%) is noted in the corner of exterior walls with the placement of a thermal insulating insert near the inner surface.

The results obtained were used to assess the impact of the marginal zones of the enclosing structures on the thermal protection properties of the envelope of the 4th building of KNUTD. On the basis of the developed methodology, the thermal protection for the design of the 14-storey 4th building of KNUTD and the design was assessed for the following calculation variants: 1 – without edge zones (basic); 2 – including edge zones (Table 1).

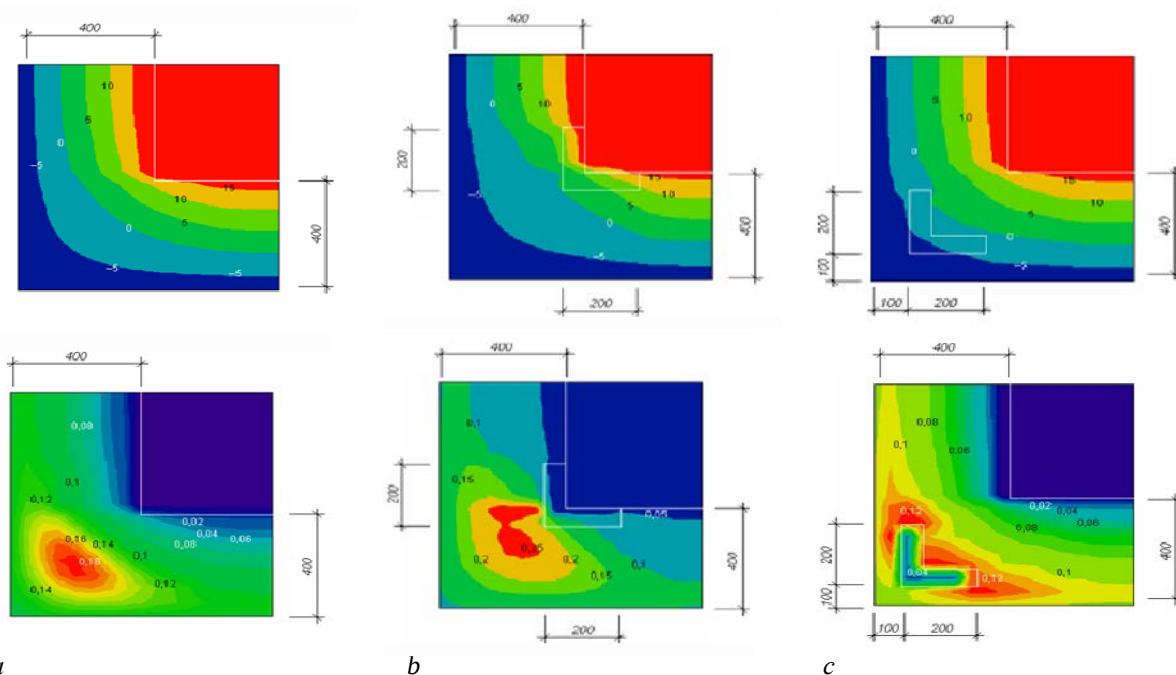


Fig. 1. Fields of temperature (top) and moisture content (bottom) in the outer corner of lightweight concrete walls

Legend: a – without thermal insulating insert; b – with thermal insulating insert at the inner surface of the corner; c – the same, at the outer surface of the corner

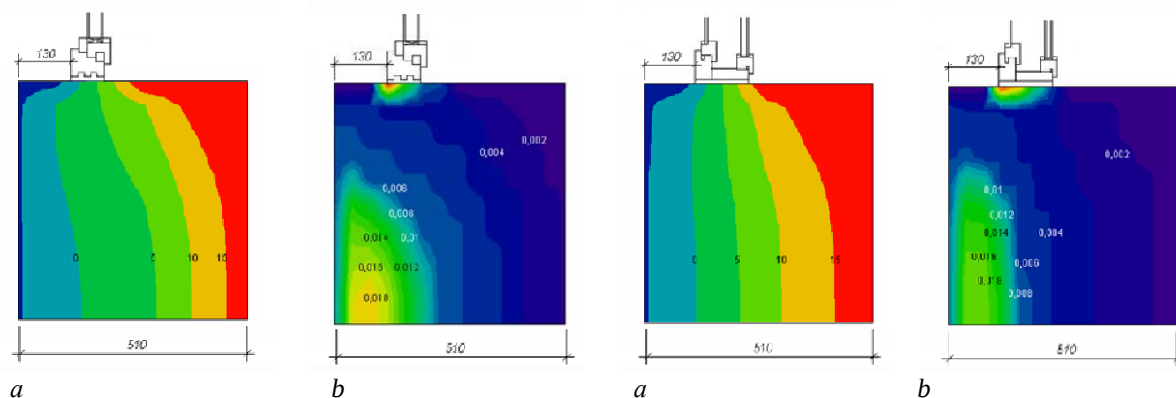


Fig. 2. Fields of temperature and moisture content at the junction of the window unit with the exterior wall

Symbols: temperature fields with a narrow box (a) and moisture fields with a wide box (b)

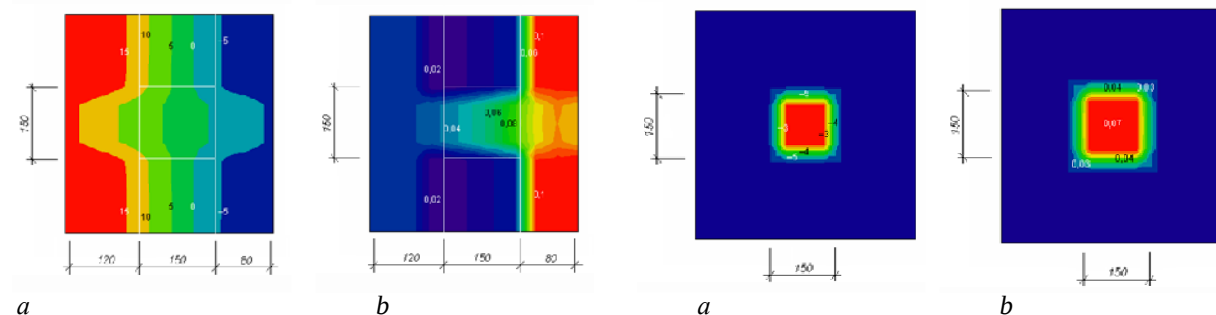


Fig. 3. Temperature and moisture fields in a three-layer wall panel

Symbols: temperature fields of the section along the keyhole (a) and moisture content at the junction of the insulation with the outer protective and finishing layer (b)

Table 1

**Thermal resistance of envelope enclosing structures of the 4th building
of Kyiv National University of Technologies and Design**

Enclosing structure	Square, m ²	Thermal resistance, m ² ·K/Bt	
		base case	including edge zones
Exterior walls	4494	4,06	2,16
Windows, balcony doors	1576	0,68	0,59
Entrance doors	55	0,78	0,78
Covering combined	412	4,22	3,38
Ceiling of warm attic	381	3,68	2,94
Ceiling over the technical floor	793	3,68	2,94

Thermal transmittance of the building envelope: according to the basic variant – 1.97 m²-K/W, taking into account the edge zones – 1.44 m²-K/W. Reduction of the reduced heat transfer resistance of the building envelope in comparison with the basic variant is 26.9%. Calculation of components q_h, q_{hw} and q_e is performed on the basis of the Directive 2010/31/EC. The proposed method has been implemented in the computer program "Energy Passport of a Building", developed on the basis of the University Knowledge Hub in the visual object-oriented programming system Delphi 3–7 for WINDOWS. The main advantages of the computer program are: calculation of energy consumption of the building taking into account all its components, including heat and electric energy consumption; determination of the structure of transmission heat losses through the fencing edge zones, which allows to improve the design solutions of energy reconstruction and energy modernization; possibility to assess the energy efficiency of the building at the stage of energy reconstruction and energy modernization.

By the example of the project of energy reconstruction and energy modernization of the building, the study shows that the temperature and humidity conditions in the marginal zones of the enclosures have a significant impact on the energy performance of the building. Consideration of the fencing edge zones increases specific transmission heat losses through the building envelope by 37%, heat energy consumption for heating by 32%, and energy consumption for building operation by 13%. Improvement of the structural solution of the outer envelopes leads to a decrease in specific transmission heat losses through the building envelope by 29%, the consumption of thermal energy for heating by 25%, the energy consumption for the operation of the building by 10%. Thus, the improvement of the edge zones of the building envelope structures has a high potential of energy efficiency.

In order to confirm the validity of the developed methods, the energy efficiency of the high-rise 14-storey operating building of the 4th building of KNUTD was assessed according to the results of the energy audit carried out by

the author. At the time of the energy audit the duration of operation of the building was about 40 years. Measurement and recording of heat energy consumption for building heating was performed by express method according to Directive 2010/31/EC. Thermal energy consumption for heating and hot water supply was monitored automatically once a day using a heat meter in the building of Building 4. The measurement results were used to test the building energy performance calculation methodology (Table 2).

Table 2

Comparison of calculated and actual specific energy indicators of the 4th building of Kyiv National University of Technologies and Design

Indicator	Value of the indicator, МДж/м ³		Deviation of the calculated value of the indicator from the actual, %
	actual	estimated	
Heat consumption for heating of the building	94.5	92.4	-2.2
Heat consumption for hot water supply	29.2	27.3	-6.5
Electricity consumption	22.2	24.1	+8.6
Total	146	144	-1.4

Comparison of the calculated values of the energy indicators obtained by the proposed method with the actual data confirms the validity of the methodology. Thus, taking into account the edge zones in the enclosures allows a more accurate assessment of the thermal protection and energy performance of buildings during the heating period, conducted on the basis of the University Hub of Knowledge.

CONCLUSION.

The effect of temperature and humidity conditions in the marginal zones of the enclosing structures on the thermal protection and energy performance of the building during the heating period on the basis of the university Hub of Knowledge was assessed. A methodology for calculating the energy performance of the building during the heating period was developed. When determining the transmission heat losses through the building envelope, additional heat losses in the marginal zones of the enclosing structures are taken into account. On the basis of this methodology, it is shown that the temperature and humidity conditions in the enclosure periphery zones have a significant impact on the building energy performance. Improving the structural solution of the external envelopes leads to a 10% reduction in the energy consumption for the operation of the building. Thus, the reduction of heat losses in the marginal zones of the enclosing structures has a high potential of energy saving of the 4th building of Kyiv National University of Technologies and Design.

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ABBREVIATIONS:

%	Percentage
COVID-19	Corona Virus Disease 2019, corona virus infection 2019-nCoV
Eq.	Formula of calculation
Fig.	Figures
HEI	higher education institution
Hub	Common connection point
KNUTD	Kyiv National University of Technologies and Design

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DEVELOPMENT OF THE INNOVATIVE POTENTIAL OF YOUNG PEOPLE ON THE BASIS OF THE USE OF THE UNIVERSITY HACKATHON ECOSYSTEM

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BACKGROUND AND OBJECTIVES.

Significant contradiction between the need of modern Ukrainian society in innovation-oriented specialist personality, on the one hand, and the level of readiness of university graduates to innovative professional activities, on the other hand, generates the problem of finding ways and means of formation of innovative potential of personality in scientific and educational environment of university on the basis of holistic dual educational concept. Problematic issues of how to organize the process of professional training of future specialists, how to promote the development of their innovative potential, what are the conditions and mechanisms of this process constitute the problem field of this study

METHODS. The research used methods – activity approach to the problem of personal development; personality-oriented approach to professional training of students; competence approach to university training of students; acmeological approach to the study of human development; mutual influence of personal and professional development; environmental approach – to the problem of formation and development of students' innovation potential. Processing of the results of the survey to determine the proportions of the main components of students' innovation potential on the basis of Hackathon ecosystem was carried out by expert method.

FINDINGS. The mechanisms for implementing the concept include the

integration of education, science and practice; analysis of innovation needs and innovation capabilities of subjects of education; creation of infrastructure elements necessary for the functioning of the innovation system at all stages of the educational process; formation of a data bank of innovative projects, ready for implementation, technology platforms, information support for the development of innovative youth potential in the scientific and educational environment of the university.

CONCLUSION. Scientific and educational environment of the university is a synthesized integrated phenomenon that systematically combines the structures of research, scientific, pedagogical and other activities in their complex interaction to implement the goals and objectives of training and professional and personal development of specialists, ready for innovative activity in the conditions of lifelong learning. The expected results of the concept are expressed in the transition to the use of modern dual educational programs, methods and technologies of educational process implementation in the university, aimed at continuous development of innovative thinking of young people, improving skills and motivation, identifying and setting tasks of creating new knowledge aimed at their solution, information search and processing, independent and teamwork and other competencies of innovative activity based on knowledge of its essence and on practical experience.

KEYWORDS: innovation potential; university; Hackathon ecosystem.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
10	1	1

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РОЗВИТОК ІННОВАЦІЙНОГО ПОТЕНЦІАЛУ МОЛОДІ НА БАЗІ ВИКОРИСТАННЯ ХАКАТОН-ЕКОСИСТЕМИ УНІВЕРСИТЕТУ

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ПОСТАНОВКА ПРОБЛЕМИ ТА ЗАВДАННЯ. Істотна суперечність між потребою сучасного українського суспільства в інноваційно орієнтованій особистості спеціаліста, з одного боку, та рівнем готовності випускників університету до інноваційної професійної діяльності, з іншого боку, породжує проблему пошуку шляхів та засобів формування інноваційного потенціалу особистості в науково-освітньому середовищі університету на основі цілісної дуальної освіти концепції. Проблемні питання про те, яким чином необхідно організувати процес професійної підготовки майбутніх фахівців, як сприяти розвитку їх інноваційного потенціалу, які умови та механізми цього процесу складають проблемне поле даного дослідження.

МЕТОДИ. У дослідженні були використані методи – діяльнісний підхід до проблеми розвитку особистості; особистісно-орієнтований підхід до професійної підготовки студентів; компетентнісний підхід до вузівської підготовки студентів; акмеологічний підхід до вивчення розвитку; взаємовплив особистісного та професійного розвитку; середовищний підхід – до проблеми формування та розвитку інноваційного потенціалу студентів. Обробка результатів опитування щодо визначення пропорцій основних складових інноваційного потенціалу студентів на базі Хакатон-екосистеми здійснювалася експертним методом.

РЕЗУЛЬТАТИ. До механізмів реалізації концепції відносяться інтеграція освіти,

науки та практики; аналіз інноваційних потреб та інноваційних можливостей суб'єктів освіти; створення необхідних функціонування інноваційної системи елементів інфраструктури всіх етапах освітнього процесу; формування банку даних інноваційних проєктів, які готові до реалізації; технологічних майданчиків; інформаційна підтримка розвитку інноваційного потенціалу молоді у науково-освітньому середовищі університету.

ВИСНОВКИ. Науково-освітнє середовище вузу є синтезованим інтегрованим явищем, що системно об'єднує структури науково-дослідної, науково-педагогічної та іншої діяльності в їх комплексній взаємодії щодо здійснення цілей та завдань підготовки та професійно-особистісного розвитку фахівців, готових до інноваційної активності в умовах безперервної освіти. Очікувані результати концепції виражаються у переході до використання сучасних дуальних освітніх програм, методів та технологій реалізації освітнього процесу у університеті, спрямованих на безперервний розвиток інноваційного мислення молоді, удосконалення навичок та мотивації, виявлення та постановки завдань створення нового знання, спрямованого на їх вирішення, пошуку та обробки інформації, самостійної та командної роботи та інших компетенцій інноваційної діяльності, що базується на знаннях про її сутність та на практичному досвіді знайомства з різними варіантами її здійснення.

КЛЮЧОВІ СЛОВА: інноваційний потенціал; університет; Хакатон-екосистеми.

INTRODUCTION.

The profound changes of socio-cultural space, which occurred during the XX – early XXI centuries, actualized the scientific interest in the problems of innovation and human abilities to innovative activity (Linnell et al., 2014). Innovative vector of state development, defined by the concept and strategy of innovative development of Ukraine for the period up to 2030, requires the construction of scientifically sound system of views, principles and priorities for the formation and development of innovative potential of the individual (Gryshchenko, 2015). In the implementation of the state strategy of innovative development it is education that acts as a carrier of the ideology of innovative renewal, and it should create the necessary conditions for innovative processes in the form of a developed environment of knowledge generation, accumulation of intellectual and creative potentials of society (Groen and Calderhead, 2015). The key innovative qualities of personality are: mobility, desire to learn throughout life, inclination to entrepreneurship, risk, international mobility (Zhurko, 2016).

The expert report on the implementation of the Strategy for Innovative Development of Ukraine for the period until 2020 points out the low level of special training of university graduates, who, having found a job after graduation, undergo a long adaptation period caused by the inability to match their knowledge with practical activities. Young professionals who have recently graduated from the university have not developed the skills to participate in projects, which require communication and management skills, as well as skills in planning and self-organization of activities in addition to professional skills. According to expert estimates, tens of thousands of advanced technological developments remain unrealized. In order to successfully promote them in the Ukrainian and foreign markets we need about 200 thousand specialists in the field of technological management and innovation activities.

The transformations taking place in the society put an imprint on many spheres of human activity and existence. In the era of formation of new technological space, changes in socio-cultural environment there is a social demand for a personality, who is able to live and work productively in conditions of global changes, uncertainty, challenges. In this situation, the issues related to human development corresponding to these transformations are actualized, and the sphere of education is considered as the most important factor of reproduction of "human capital", which determines the further progressive development of the country (Stoltzfus et al., 2017).

The changes taking place in the society, complication of professional tasks make the demand for higher education institutions to train specialists for innovative activity urgent. In order to develop students' innovative potential, modern educational process in higher education institution should have a

personal-professional orientation. A significant factor in the development of students' innovative potential is the educational environment and psychological and pedagogical support of the educational process.

The main contribution to the formation of innovative activity competences is made by the education system. The main role in the development of innovation system is assigned to universities not only due to the fact that they are the key institutions of knowledge production and concentration, providing its generation, actualization, distribution and application in the process of educational and research activities, but also because the educational space of universities lays the innovation potential of the future specialist. The priority role of education system in creating conditions for innovative development is conditioned by the fact that all its stages should be focused on the formation and improvement of skills and competencies of a person, who will be able to successfully solve the tasks of innovative development of Ukraine in the future, easily adapt to rapid social changes.

The analysis of knowledge economy concepts allows us to characterize it as post-industrial, informational, globalizing, networked, innovative, in which knowledge enables the generation of a continuous flow of innovations. Innovation does not simply become a response to the dynamically changing needs of society, but also stimulates their further development.

The innovative potential of man, included in socio-economic relations, is an important factor of social transformation and innovative progress of Ukraine.

The concept of "potential" includes the possibility of expanding the boundaries of the traditional subject of the study of what a person is, to what he can become. In a wide range of scientific works the term "potential" is most often used not in a specific scientific way, but metaphorically – as a synonym of terms "resources" or "opportunities" (for example, aesthetic potential, economic and production potential, science potential, development potential, etc.). The innovative potential of a person can be considered as a set of personal properties and abilities "to create, perceive, implement innovations, as well as in time to abandon outdated inappropriate ways of activity" (Groen and Calderhead, 2015).

J. Yao, H. Li, D. Shang, L. Ding note that the main characteristic of a subject of innovation is his activity self-consciousness, i.e. the understanding of his personal initiative as subjectively possible and socially accepted basis of his own existence (Yao et al., 2021). At the same time a person can have both aspiration to develop his/her own innovation potential and internal resistance. Let us point out that it is within the framework of sociology that the issues of innovation susceptibility and resistance to innovation from the perspective of the human factor are addressed. The social characteristics of innovative thinking carriers have a significant influence on the course of the innovation process.

These objective and subjective properties of the carriers of the innovative way of thinking in practice are embodied in an innovative type of behavior.

In connection with the relevance of the above it is necessary to note the increasing interest of domestic researchers to the problem of innovative potential of university students, because in the youth educational environment there are acquisition of knowledge, abilities and skills on specialty, formation of professional identity and exposure to the range of professional problems, which university graduates will solve in the future. Student age due to psychological and physiological characteristics allows to better reveal and individualize creative abilities, initiative, ingenuity, non-standard approach, as well as the ability to take risks and be responsible for the actions taken, which is especially characteristic for the formation and implementation of the innovative potential of the individual.

The introduction of innovative technologies in various spheres of human life leads to dramatic changes in the requirements for the preparation of young people for the upcoming professional activity. One of the main issues considered today is the efficiency of modern educational process in higher education institution aimed at graduating competitive specialists able to work fruitfully in knowledge-intensive industries, participate in innovations, building post-industrial society (Linnell et al., 2014)

Today, when the society enters the era of knowledge, high technology, human creativity, his professionalism, flexible response to changes in the external environment are valued. With the importance of all levels of education, the process of preparing young people for future professional activities in higher education institutions acquires special importance. A modern specialist must be able to respond to challenges, set tasks and solve them, have a broad outlook, be open to new formats, constantly develop, be a subject of labor primarily in the status of a creative person, respond to innovations, find solutions to non-standard problems.

Speaking of preparing young men and women for independent professional activity, it is necessary to take into account the tasks that they will have to solve in this age period. This is the time when they think about the future. The prospects of tomorrow become the main dimension for them, the independence of the individual is asserted, the complexity of social life takes place. The social situation of development for young people is characterized by the fact that society sets before them the task of professional self-determination. This period is significant in terms of the development of value orientations, life positions, the formation of a worldview, a conscious attitude toward life, the recognition of oneself as a member of social community, the choice of social position and the ways to achieve it. The leading activity at this time is educational and

professional. It is in this activity that mental processes and personal peculiarities of students develop to the maximum (Groen and Calderhead, 2015).

An important component of the modern educational process in higher education institutions is the development of innovative potential of students. A. Stoltzfus, M. Rosenberg, H. Lapp, analyzing the concept "innovation potential", first of all, distinguish personal qualities of a person (tolerance to uncertainty, ability to justified risk, responsibility, need for self-realization, motivation of achievement, reflexivity, creativity (qualities of intellect, intellectual initiative); competence, ability to interact with other people, features of value and semantic sphere, working capacity, self-regulation level (Stoltzfus et al., 2017).

N. Linnell, S. Figueira, N. Chintala emphasize such personal parameters, testifying about the developed innovative potential, as aspiration to novelty, sensitivity to contradictions, openness to experience, ability to act in unpredictable, unstructured situations (Linnell et al., 2014).

Competences and personal characteristics that constitute innovation potential help a person not only to carry out innovative activity, but also to the maximum extent self-realization. The development of innovation potential is closely connected with the processes of self-improvement and self-development of a person. A person, developing his innovation potential, "expands his own space of life, horizons of his consciousness, his being in the world" (Linnell et al., 2014).

Proceeding from the fact that modern reality makes it necessary to train a specialist with innovation potential, higher education institutions should create an optimal educational environment for young people to acquire competitiveness in the labor market and professional development.

In order to develop students' innovative potential, modern educational process in a higher education institution should have a personal-professional orientation, i.e. be focused not only on transferring specific knowledge, abilities, skills to a future specialist, but also develop the personality of a student in the educational process. The need for personal development of a modern specialist is indicated in the competences of educational programs of higher education institutions. In the context of the challenges of society, global changes, it draws us to the realization that the human resource is fundamental in all transformations. From this point of view, the development of personal competences can be considered as one of the central characteristics of the educational environment of a modern higher education institution.

Self-development is very important in unlocking an individual's innovative potential. D. Groen, B. Calderhead in their works repeatedly drew attention to the fact that for a person is significant outgrowth of development in self-development. This manifests itself in activity. These scientists emphasized that

routine work, as a rule, does not serve the development of a person. But the solution of tasks requiring the active work of the intellect, motivation and volitional manifestations, creation of something new, non-standard, provides the development and self-development of a person (Groen and Calderhead, 2015).

I. Gryshchenko interpreted such situations as follows: "In creativity the creator himself is also created. There is only one way to create a great personality: great work on a great creation". It can also be fully referred to innovative activity where a person is improved in accordance with the principle of personal development in activity (Gryshchenko, 2015).

T. Zhurko emphasized that "the social value of his personality and socially significant potential which he is able to realize in his deeds, but also the character of that new frontier on which he comes in his development depends not only on the value of creative-innovative caliber of deeds of the person, on degree and quality of investment of his mind, feelings, will in these deeds" (Zhurko, 2016). Innovative activity contributes to the transformation of potencies into opportunities, development of reserves, finding solutions to increasingly complex problems and at the same time stimulates the transition of a person to higher stages in their development. Participation in innovative projects contributes to the change of individual, personal and subjective characteristics of students. The scale of innovative activity tasks, mental activity of the person performing it, the degree of motivational involvement and engagement in the activity largely influence his/her personal and professional development.

The hypothesis of the study is represented by a number of assumptions to be developed and tested in the study:

- the concept of formation of innovative potential of the personality will have high explanatory possibilities if it is based on the use of systemic, integrative-activity, personality-oriented, competence-oriented, acmeological approaches and includes the description of regularities, principles, model, algorithm, efficiency criteria, necessary and sufficient psychological conditions and mechanisms of this process;

- the effectiveness of the concept implementation in the practice of professional training is provided by the reliance on the model, conditions, factors and characteristics of the scientific and educational environment, providing a personality with the opportunity to gain experience of innovative activity and creating conditions for the formation and development of its innovative potential;

- the main directions of development of personal innovative potential should correspond to its main structural components, which are innovative orientation, innovative competence and innovative creativity;

- the effectiveness of the formation of the innovative potential of the individual assumes: a) the development of strategy, tactics and technology dual educational process based on the model of innovative potential; b) implementation of high-quality diagnostics of the level of formation of innovative potential of the individual in its stages of formation; c) comprehensive accounting of diagnostic data in the process of formation; d) development and implementation of support program of this process, technology and infrastructure support stage-by-stage improvement of the level of innovation potential of the individual; e) the development of the innovative potential of the individual.

The aim of the article is to develop the innovation potential of young people on the basis of the use of the university Hackathon ecosystem. The study is based on the data of Kyiv National University of Technologies and Design in 2021.

MATERIALS AND METHODS.

The contradiction between the need of modern Ukrainian society in innovation-oriented specialists and the level of readiness of university graduates to innovative activity in professional sphere generates the necessity of searching the ways and means of formation of innovative potential of personality in the scientific and educational environment of university (Gryshchenko, 2015). That is why the sociological research "Innovative potential of student personality: formation in the scientific and educational space of university" in KNUTD at the Faculty of Management and Business Design was carried out. The method of collecting information was a questionnaire survey. The choice of quantitative methodology corresponded to the nature of the tasks to be solved.

The aim of the research was to study the innovation potential of students and to identify the problems of its formation in the scientific and educational space of the university. 196 students of 1–3 years took part in the survey. The sample is representative of the number of students in different training areas of the Faculty of Management and Business Design of KNUTD. The survey was conducted in April 2021.

Difficulties in research of innovative potential are caused by absence of the generally recognized idea about the content and structure of the given concept. The main reason for this is the complexity and multifaceted nature of the innovation potential of the individual in general and the student in particular.

At present the considered problematic touches upon different fields of knowledge, which offer their own approaches for researching the totality of creative, educational and social aspects of innovative activity. Undoubtedly, the leading position in the study of innovation potential of the individual is taken by social psychology. Psychological problems of innovation are partially reflected in other fields of knowledge, and as a result, related and interdisciplinary

approaches to the analyzed phenomenon are formed. The influence of the psychological approach is also found in sociological studies.

We can agree with the previously indicated authoritative opinion that the innovative potential of the individual should be interpreted as a set of personal properties and qualities that allow "create, perceive, implement innovations, as well as timely abandon outdated unreasonable ways of activity". Based on the notion of personal potential as a set of resources for the implementation of innovative activity, many authors propose to study personal qualities and competencies necessary for innovative activity.

Determination of the proportions of the main components of the innovation potential of the students surveyed on the basis of the Hackathon ecosystem is carried out with the help of equation (1):

$$\mu C_1 = \frac{\sum A(R_1) \dots A(R_n)}{n}, \quad (1)$$

where $A(R_{1...n})$ – students' answers;

$C_1 \dots C_{10}$ – evaluation criteria;

$\mu C_1 \dots C_{10}$ – the total numerical score of all students surveyed.

RESULTS AND DISCUSSION.

Innovative activity motivates students to go beyond their own limits, helps to expand the system of perceptions, mobilizes its potential, stimulates human self-development. Thus, the complication of realized activity leads to the development of personality through its self-transformation, internal self-transformation work, qualitative transformations.

Since modern strategies of preparing young people for professional activities are determined not only by the formation of knowledge, abilities and skills, but also by significant personal transformations, its self-realization in the professional space, the desire to present its point of view to the world, the university should be focused on creating an innovative environment in the formation of students' competences. That is to create conditions that provide prerequisites for effective formation and development of innovative activity, where the opportunity for implementation of new technologies of problem solving is provided.

The functioning of this environment should be based on a system analysis of the object, subject, processes, conditions of innovative development. In addition, it is important to determine the criteria of effectiveness of the environment from the position of implementation of the principle of continuous development of participants in the educational process. Such approach makes it possible to optimize the process of personal and professional formation of a future specialist, to develop students' ability to generate new ideas, generate new

technologies, and create new products. In order to stimulate the development of students' innovative potential, it is necessary for them to gain personal experience of participation in the development and implementation of innovations, practical implementation of promising innovative projects. In addition, it is important for students to be able to participate in their education, choose an individual educational trajectory, show educational initiatives and implement them in educational and research activities.

When considering the process of training young men and women for innovative activity in conditions of high competition, increasing complexity of tasks, the question of psychological and pedagogical support of the educational process in the formation of innovative potential of students becomes relevant. It is known that one of the main principles of psychological and pedagogical support of the educational process is to take into account individual characteristics of students, their capabilities, development of resources. This process should be aimed, first of all, at actualization of personal competences, which determine innovation activity. Its main components are diagnostics, which would be focused on identifying students' resources when solving non-standard tasks in a situation of uncertainty, determining individual trajectories of their entry into innovation activity, supporting participants of innovation projects, developing programs for monitoring the results of psychological and pedagogical support of educational process participants.

The relevance of psychological and pedagogical support of the educational process in the university is also associated with the fact that the student age is characterized by the focus on self-knowledge, self-affirmation, personal self-determination, which act as a need for young people to take the internal position of an adult, to realize their place in society, to understand themselves and their capabilities (Groen and Calderhead, 2015). Psychological and pedagogical support of educational process should also be focused on development of reflection of young people, ability to correlate their abilities, pretensions with requirements of society, on comprehension in full of social expectations from their work. An important component of psychological and pedagogical accompaniment is to help students organize their cognitive activity, develop communicative abilities, value and semantic reference points.

The innovative potential of a person is realized in direct practical activity. Any human activity requires active manifestation of personal properties. Activity is a measure of interaction of a subject with the surrounding reality as a special way of self-expression in society, at which a higher level of development is achieved, reflecting not so much quantitative characteristics of activity as qualitative ones. The innovative potential of a personality is an integrative characteristic of a personality in a set of personal properties, qualities and abilities, providing its readiness to generate new forms of activity on creation,

development and distribution of innovative educational products, as well as self-development and personal growth as a strategic factor of productive innovative activity (Yildizer, 2017). The innovative potential of a personality in scientific and educational environment of higher education institution implements target, motivational, creative, prognostic, transformational functions, function of development and formation of innovative experience and practice-orientation.

There are three components of innovation potential. The first one is professional competences, important in development of innovations (understanding of strategic goals of organization and society development, ability to see problems clearly, breadth of knowledge, well formed abilities and skills of professional activity, diverse interests, ability to generalize special knowledge, ability to analyze problems objectively, ability to see other people's capabilities and use them for business, effective feedback skills, high work capacity). The second component – creativity (intuition, flexibility of mind, extensive associations, unusual view of things, originality, the ability to see the subject from different sides, the ability to recognize only emerging trends) (Lopatenko, 2016). The third element is entrepreneurialism as a resource for promoting innovation (high level of motivation for success and risks, knowledge of the market, trends in its development, initiative, the ability to find new uses for the "object", flexible work style) (Stoltzfus et al., 2017). In most studies innovative potential of the personality of a modern specialist in the most generalized form is considered as a set of motives, properties and qualities of the personality, manifested in new, non-standard ways of activity in order to satisfy the existing and newly arising material, social and spiritual needs (Taylor, 1999).

Based on the analysis and synthesis of existing approaches to the definition of the category "innovation potential of the personality" we formulated the concept "innovation potential of the student personality": a set of social and creative qualities of the student personality (entrepreneurial spirit, competence, creativity) and motives that characterize his readiness for innovative activity (Riesener et al., 2019). The set of important features of innovative personality of a student appears as follows:

- enterprising – the presence of an active life position, initiative, the ability to find solutions in difficult situations, the ability to take responsibility, communication skills;
- competence – breadth of knowledge, diverse interests, confidence in professional choice, high working capacity;
- creativity – active creative and intellectual development, manifested in research activities or in extracurricular activities of the university.

Analysis of sociological research data showed that most of the students to a greater or lesser extent have qualities of innovative personality. In particular,

about a quarter of the respondents have no doubt that they have an active life position (24.5%), the same number of respondents expressed their readiness to take responsibility in a critical situation and demonstrate such qualities as resourcefulness and ingenuity. Using the most common methods to assess the level of development of youth innovation potential (M. Kirton's Method; Method STYLES; "Simplex method" M. Basadur; The Method of Rotter) allows ranking the degree of manifestation of the main components of innovative potential in students (tab. 1).

Table 1

**Assessment of the level of development of the main components
of innovation potential of young people**

Methods	Indicators of innovation potential	Minimum	Maximum	Average value	Standard deviation
M. Kirton's Method	The coefficient of innovation (KAI)	2,1	127,1	112,27	18,12
Method STYLES	Composite index of innovation (CI)	12,1	121,1	115,22	12,86
	Creativity of thought	9,1	22,1	22,41	4,22
	Purposefulness of decisions	11,1	25,1	26,11	2,91
	Focused on Achieving the Goal	11,1	28,1	27,96	4,41
	Social partnership	12,1	25,1	27,91	4,19
«Simplex method» M. Basadur	Involvement in research	11,1	122,1	41,14	11,87
	Ability to generate ideas	7,1	124,1	28,67	14,62
	Ability to think	11,1	125,1	25,65	12,87
	Ability to assess the situation	12,1	126,1	29,94	14,57
The Method of Rotter	General internalism (inclination to take responsibility for the events on oneself), points	8,5	57,1	22,81	24,21
	General externality, (inclination to attribute the causes of events to external factors), points	2,1	8,5	5,2	2,2

About a third of the students (20.6%) can easily establish contacts with people, which indicates a high level of sociability. About half of the respondents not fully possess these qualities (51.5% doubt their own active life position, 58.7% are not ready to take responsibility in a critical situation, and 42.9% have difficulties communicating with people). An active life position, serving as a basic component of innovation activity in the future, was inherent in the respondents back in school. Only 12.5% of the study participants did not attend additional classes, the rest chose sports sections (49.2%), various types of electives (48.7%), engaged in creativity (18.5%). While studying at the university, students preferred primarily the scientific sphere, participating in conferences and projects (55.0%) as an additional activity.

In "extracurricular trajectories" at the time of the survey 20.6% of respondents participated. The most popular were: international relations – 22.2%; leadership and initiative – 27.4%; entrepreneurship – 17.7%; culture and creativity – 16.1%. However, the classes are fully satisfied only a third of respondents.

To improve the effectiveness of the trajectories and the development of motivation students suggest the organizers to invite more interesting people, experts, speakers to hold events (28.2%), also students would like to update the methods of classes (26.7%) and diversify activities in the areas and profiles of training (25.0%). The main reason for non-participation in extracurricular activities respondents indicate a lack of interest – 27.4%. Sufficiently high level of respondents' satisfaction with their professional choice (60.2%) creates the basis for successful formation of professional competences and indirectly indicates the presence of competence as the most important characteristic of innovative personality.

Research and development activities should play a huge role in professional development of a specialist in innovative society. It contributes to the manifestation of creativity as an intellectual basis of innovations in any sphere. The majority of respondents (62.7%) are sure that a student should necessarily participate in such work during his/her studies. However, as the results of the questionnaire showed, only 12.8% of respondents take an active part in it, 28.2% participate sometimes, 24.0% have a desire, but it has not yet been realized. These data indicate the possibility and need for further expansion of research activities. Most of the respondents are satisfied with the conditions created in the university for the creative and intellectual development of the student (65.9%). And 48.4% of the respondents have ideas about creating a brand or firm. These survey participants, as well as those who still doubt their ideas (27.1%), would be helped to become more confident and active by attending Hackathon activities, because this is where a creative environment for the implementation of business projects and business ideas should be formed. Nevertheless, the survey found that only 27.7% of respondents attended the Business Hackathon events, and the majority (62.7%) did not participate in it. Lack of time (29.7%) and lack of interest (24.1%) were cited as the main reasons for this. The main purposes of visiting this site respondents consider getting information at expert lectures (65.8%), meeting new people (26.0%), turning business ideas into reality (19.8%), and acquiring the necessary knowledge and skills (19.8%).

The cluster analysis of the research results allowed us to identify and describe three groups of respondents by the level of innovation potential development: active innovators (48.4%), potential innovators (24.9%) and passive innovators (16.7%). Active innovators show a high level of participation

in research activities and are more often involved in extracurricular trajectories, the majority of such students are second-year students. The peculiarities of potential innovators are low self-esteem in the field of entrepreneurship, also low degree of awareness of a variety of activities in extracurricular and academic activities of the university. However, in this group there are a lot of those who have a desire to be active and develop their innovative potential. Such students are in the majority in the first year. Passive innovators are characterized by low level of participation in extracurricular trajectories and scientific and educational space of the university, but they are characterized by high assessment of their own entrepreneurial spirit, which can serve as a basis for development of innovative potential in the sphere of business and entrepreneurship. The majority of such respondents turned out to be in the third year (Fig. 1).

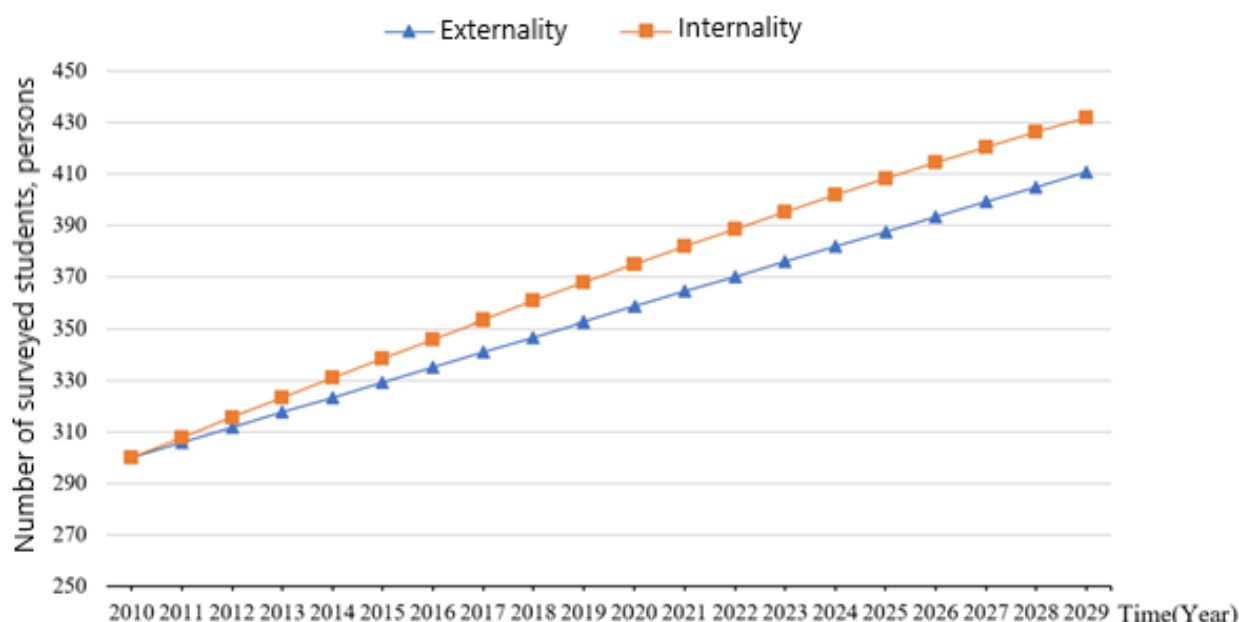


Fig. 1. Forecast of the ratio of internality and externality of the development of innovation potential of young people

Thus, the survey of students of Kyiv National University of Technologies and Design allowed us to establish that most of them are aware of the importance of development of personal innovation potential in the scientific and educational space of the university and almost half of them show a high level of innovation activity already in the university, participating in research activities and expressing interest in a variety of extracurricular trajectories of personal development. Most students are satisfied with their professional choice and the conditions created by the university for the development of human innovation potential. At the same time, the following problems are revealed: there is a low

level of activity and poor awareness of various activities in extracurricular and research activities of students, who constituted the majority in the cluster of potential innovators; there is a tendency of decrease in the level of innovative potential among third-year students in comparison with that of second-year students; a significant part of the respondents shows weak motivation and participation in research work and attendance at business-Hackathon.

Thus, the development of students' innovative potential becomes an important component of the educational process of a higher educational institution today. For this purpose, in addition to professional development of future specialists, it is necessary to carry out personal development. Invaluable role here can play psychological and pedagogical support of students' entry into innovative activity, largely contributing to the transition process of personal development in self-development. The study of the issue of personal self-development as a significant resource for the formation of innovative potential of students in the educational process is of great practical importance, helps in preparing young people for professional activity in modern conditions.

A new stage of social development, knowledge-intensive economy make urgent the need to develop innovation potential, personal formation of future specialists, as it is the personality that acts as a carrier and exponent of universal resources of civilization transformation. This creates the need to study the development of personal innovation potential in the process of learning in higher education.

CONCLUSION.

Thus, on the basis of generalization of studies of the essence and structure of personal innovation potential we have developed the following definition. The innovative potential of a personality as a subject and participant of scientific and educational environment of a university is an integrative characteristic of a personality in a set of personal properties, qualities and abilities that ensure its readiness to generate new forms of activity in creating, mastering and distributing innovative educational products, as well as self-development and personal growth as a strategic factor of productive activity. It is necessary to create favorable conditions for the development of innovative potential in all types of educational and extracurricular activities, to expand innovative forms of scientific and educational space of university and to improve motivational mechanisms of intellectual, creative and entrepreneurial activity of students. In particular, as the research results have shown, it is necessary to involve students more actively, starting from the first years of study, in research work, which significantly develops the innovation potential of an individual. The results of the surveys also allow us to conclude that individuals with high innovation potential may have a subjectively higher assessment of the quality of life. In addition, they are potentially able to put more effort into changing the objective

characteristics of the quality of life. Therefore, the work on the formation of innovative activity of students in general can help to improve the life of the entire Ukrainian society in the future.

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ABBREVIATIONS

<i>Eq.</i>	Equation
<i>fig.</i>	Figure
<i>HEI</i>	Higher education institution
<i>HE</i>	Hackathon Ecosystem
<i>KNUTD</i>	Kyiv National University of Technology and Design

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ADAPTATION OF STUDENTS TO RESEARCH AND PROFESSIONAL ACTIVITIES BASED ON THE USE OF THE UNIVERSITY HACKATHON ECOSYSTEM

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BACKGROUND AND OBJECTIVES. For student youth the process of entering the profession and harmonization of interactions with professional environment and future professional activity is the key moment of life activity. This process, according to the majority of modern researchers, is a certain complexity and contradiction both for students and for higher education institution, as well as social institutions and organizations acting as social customers.

METHODS. The study of the process of adaptation of student youth to research and professional activity was carried out on the basis of the Kyiv National University of Technologies and Design. Assessment of students' expectations regarding studies, the level of students' awareness of the future professional and scientific activity was carried out with the help of the University Hackathon Ecosystem toolkit. Processing of the obtained results of the survey was carried out on the basis of the "Methodology of research of students' adaptability to dual education in higher education". The methodology includes two scales: adaptability to professional activity and adaptability to research activity.

FINDINGS. The following directions of training are distinguished: professional, social and research, as well as stages of adaptation to professional training: learning identification, learning-professional

activation, professional-value reflection. Integration of these directions allows us to organize activities that ensure formation of necessary professionally important qualities (competences) in students (graduates), agreed with potential employers and demanded by the corresponding profession. The conducted experiment on the basis of Hackathon-ecosystem of the university was carried out taking into account the directions of training and their corresponding adaptation criteria: professional direction – activity-result and motivation-value criteria; humanitarian – communication-professional criterion; research – personal-creative criterion.

CONCLUSION. Students' adaptation to future professional and research activities can be defined as one of the most urgent social problems at the pre-production stage. This is due to the fact that the student spends one of the main periods of his life in a higher education institution, since it is at this time he is formed as a professional and as a person, masters the necessary competencies in order to achieve a certain professional and research level. At this stage the professional intentions of the individual and the requirements of the profession come into alignment, i.e. there is an adaptation to professional and research activities.

KEYWORDS: Hackathon ecosystem; adaptability; professional and research activities; institution of higher education.

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АДАПТАЦІЯ СТУДЕНТСЬКОЇ МОЛОДІ ДО НАУКОВО-ДОСЛІДНОЇ ТА ПРОФЕСІЙНОЇ ДІЯЛЬНОСТІ НА БАЗІ ВИКОРИСТАННЯ ХАКАТОН-ЕКОСИСТЕМИ УНІВЕРСИТЕТУ

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ПОСТАНОВКА ПРОБЛЕМИ ТА ЗАВДАННЯ. Для студентської молоді процес входження у професію та гармонізація взаємодій із професійним середовищем та майбутньою професійною діяльністю – ключовий момент життєдіяльності. Цей процес, на думку більшості сучасних дослідників, є певною складністю і суперечливістю як для студентської молоді, так і для вищого навчального закладу, а також соціальних установ та організацій, які виступають як соціальні замовники.

МЕТОДИ. Дослідження процесу адаптації студентської молоді до науково-дослідної та професійної діяльності здійснено на базі Київського національного університету технологій та дизайну. Оцінку очікування студентів щодо навчання, рівень поінформованості студентів про майбутню професійну та наукову діяльність здійснено за допомогою інструментарію Хакатон-екосистеми університету. Обробка одержаних результатів опитування проводилася на підставі «Методики дослідження адаптивності студентів у ВНЗ до дуальної освіти». Методика включає дві шкали: адаптивність до професійної діяльності та адаптивність до науково-дослідної діяльності.

РЕЗУЛЬТАТИ. Виділено такі напрями підготовки: професійний, соціальний та науково-дослідний, а також етапи адаптації до професійної підготовки: навчальна ідентифікація, навчально-професійна активізація, професійно-

ціннісна рефлексія. Інтеграція даних напрямків дозволяє нам організувати діяльність, яка забезпечує формування у студентів (випускників) необхідних професійно-значущих якостей (компетенцій), узгоджених з потенційними роботодавцями та затребуваних відповідною професією. Проведений експеримент на базі Хакатон-екосистеми університету здійснювався з урахуванням напрямів підготовки та відповідних їм критеріїв адаптації: професійний напрямок – діяльнісно-результативний та мотиваційно-ціннісний критерії; гуманітарне – комунікативно-професійний критерій; науково-дослідний – особистісно-креативний критерій.

ВИСНОВКИ. Адаптацію студентів до майбутньої професійної та науково-дослідної діяльності можна визначити як одну з найактуальніших соціальних проблем на довиробничому етапі. Це зумовлено тим, що у вищому навчальному закладі студент проводить один із головних періодів свого життя, оскільки саме в цей час він формується як професіонал і як особистість, що опановує необхідні компетенції з метою досягнення певного професійного та науково-дослідного рівня. На даному етапі професійні наміри особи та вимоги з боку професії приходять у відповідність, тобто відбувається адаптація до професійної та науково-дослідної діяльності.

Ключові слова: Хакатон-екосистема; адаптивність; професійна та науково-дослідна діяльність; заклад вищої освіти.

INTRODUCTION.

The process of modernization of higher education in Ukraine is due to intensive changes occurring in all spheres of social and economic life. Universities are designed to provide training of highly qualified specialists, capable of professional growth and professional mobility in the constantly changing conditions of life. In this regard, the problem of students' adaptation in the educational environment of the university does not lose its relevance. Mobility, competitiveness, ability to self-development and self-education acquire professional and moral character for each professionally active person (Linnell et al., 2014). The modern market of professions is filled with young specialists who do not have the necessary professional education. Many have not formed social and professional-moral qualities, professional culture, often they do not need it (Groen and Calderhead, 2015). Practice shows that most of the products created by them are in demand in a short period of time, which does not allow improving the quality of professional training. A similar phenomenon was observed among young people during the formation of industrial society. When adolescent labor began to be used, no thought was given to the social and personal consequences of the lack of professional and moral qualities in the young people involved in the labor process.

Modern post-industrial society actualizes the problems of individual socialization and professional socialization. The process of professional socialization can be considered in the context of "lifelong learning", which makes it difficult to distinguish the subject of education (Yildizer, 2017). The subject of education should be connected with the surrounding activity, regardless of where it takes place in the surrounding society (Scherbak and Arabuli, 2021). The answers to the questions related to early professionalization of a person can be found in the system of higher education (Krakhmalova, 2021).

The era of post-industrialism imposes new requirements on the personality of the professional (Goncharenko, 2021). However, a balance, a measure in the combination and mutual enrichment of traditional and new, innovative means of socialization is very important. Some scholars often search not for new ideas and strategies, but for ready-made solutions or algorithms (Gryshchenko, 2015; Zhurko, 2016; Taylor, 1999; Lopatenko, 2016). The search for new non-standard solutions requires a different way of thinking from the growing person, the formation of integrated knowledge, the ability to construct ideal images of socially-oriented orientation (Hanushchak-Yefimenko, 2021). Professionalization of young people is focused on personal development, formation of socio-moral qualities, formation of understanding of the new society, formation of human capital, preservation and strengthening of human health (Lopatenko, 2016).

The adoption of the competence model of education in an uncertain and unstable economy assumed that its implementation would solve various socio-

economic problems (Dudko, 2021). For higher education it meant bringing the quality of training in line with the achievements of scientific and technological progress (Zhurko, 2016).

We often do not think about the fact that professional training in higher education is accompanied by high intellectual loads, irrational intensification of educational activities, unfavorable social and educational environment, negative environmental loads associated with professional activities, hypodynamia, emotional stress, non-compliance with healthy lifestyle requirements, lack of awareness in maintaining professional health and safety. At the same time, the complexity and intensity of the educational process, insufficient awareness of the value of the profession, the lack of ability to rationally allocate time for independent work makes it difficult for a university graduate to successfully adapt to the new socio-professional environment. The presence of emotional, environmental and industrial stressors affects the health and performance, i.e. the competitiveness of the graduate. It is impossible to solve these problems without developing professional-valuable attitude towards professional activity on the basis of integrating professional, humanitarian and health-saving knowledge, which allows developing general human and professionally important qualities in a graduate and successfully realizing the adaptive possibilities of the organism without any harm to own health.

It is known that the adaptation process takes place during the whole period of higher education, but the initial period of higher education is sensational for the development of adaptive properties of personality and ways of behavior (Riesener et al., 2019). In the process of adaptation of recent schoolchildren to student life there are psychophysiological, psychological and social levels. Adaptation requires involvement of psychophysiological reserves of the not yet fully formed organism and is associated with the crisis of adolescence, an important stage of personality formation. Typical difficulties of students are caused by both external (objective) and internal (subjective) factors among which there are factors reflecting the level of pre-university training; factors characterizing individual characteristics of a student as a subject of adaptation process; factors related to the learning conditions; factors related to living conditions in the family (Gryshchenko, 2015). The process of university adaptation is not a passive adaptation of a student to the conditions and influences of educational environment, adaptation involves active interaction of a student with educational environment, in the course of which the development and transformation of a student's personality takes place.

The aim of the study is to propose a model for student youth adaptation to research and professional activities based on the use of the university's Hackathon ecosystem. The study was conducted in 2021 on the basis of the

results of the survey of students of Kyiv National University of Technologies and Design (KNUTD).

MATERIALS AND METHODS.

The study of the process of adaptation of student youth to research and professional activity was carried out on the basis of Kyiv National University of Technologies and Design.

Assessment of first-year students' expectations regarding studying in KNUTD, the level of students' awareness of future professional and scientific activity was carried out with the help of the University Hackathon Ecosystem toolkit.

The processing of the survey results was carried out on the basis of the "Methodology for studying students' adaptability to dual education in higher education". The methodology includes two scales: adaptability to professional activity and adaptability to research activity.

RESULTS AND DISCUSSION.

The problem of a person's adaptation to future professional activity begins long before entering the university and is connected with personal-professional formation, i.e. with his professional socialization. Professional training is one of the stages of formation. The process and results of professional training influence a graduate's readiness to accept the future profession and future professional activity. In this regard, it is necessary to significantly modify the very educational process, the process of professional training, giving them a subject-oriented orientation.

The organization of purposeful pedagogical process, in which students solve professional tasks and have an opportunity to simulate future professional activity, significantly affects their professional socialization in real practice. Consequently, the specificity of an educational institution, peculiarities of professional training organization significantly influence the professional formation of a university graduate (Linnell et al., 2014; Lopatenko, 2016). The improvement of professional training quality and the formation of various competences in a university graduate is determined by the effectiveness of his/her adaptation to professional training (Stoltzfus et al., 2018; Yildizer, 2017).

Let us consider students' adaptation to professional training from the position of their value orientations to education and profession. We consider this process as an element of a unified process of social, professional, psychophysiological entry of a student into educational environment of a university and into future professional activity. At the same time, professional training of university students is aimed at forming not only knowledge and skills, but also readiness for interaction and cooperation, aspiration for sustainable professional growth, culture of professional health and safety. The process of students' adaptation to future professional activity is considered

taking into account the analysis of socio-psychological, professional-pedagogical, medical-physiological aspects and is a complex psychological and pedagogical task.

The medico-physiological interpretation of the studied concept gives grounds to conclude that adaptation is a functional indicator of a graduate's health state, affects the result of educational activity and successful entry into future professional activity.

The main way of social adaptation is the adoption of norms and values of the new social environment (group, collective, organization), established forms of social interaction (formal and informal connections, leadership style, family relationships, etc.), as well as forms of subject activities (ways of professional performance of work or family responsibilities). Psychological aspect of this problem is associated with the peculiarities of mental processes, personality traits of a student. The process of learning, student's assimilation of professional values, norms and attitudes of behavior puts an imprint on his attitude to education as a value and on future professional activity.

In the first stage of experimental work (2020–2021) a survey was conducted. More than 50 teachers and 500 students from Kyiv National University of Technologies and Design participated in the survey. 94% of the interviewed teachers understand the necessity of solving the problem of students' adaptation to professional training in the university. At the same time, they note that they have insufficient knowledge, methods and technologies necessary for this. In addition, it was found that 90% of the teachers-experts believe that professional training requires professional knowledge and skills, 92% – the humanities knowledge and 94% – knowledge of the opportunity to participate in research work.

According to 46% of students, adaptation to professional training begins directly at the company, and 14% consider adaptation to professional training "as an opportunity to fit into the team, into student life". 29% of students associate adaptation to professional training with "getting used" to learning activities and future profession, and 12% of students had difficulty in defining the concept of "adaptation to professional training. On the basis of the Kyiv National University of Technologies and Design a study was conducted to study the process of students' adaptation to the educational environment of the university. On the first academic day, a written survey of first-year students revealed students' expectations regarding studying at KNUTD, a total of 50 people (out of 69) were interviewed. The following table presents the motives for choosing a university and profession in descending order of importance. It should be noted that respondents could choose several of the proposed answer options (Table 1).

Table 1

Results of a survey of students about their motivation for choosing their future profession and place of study

Motives for choosing a university and profession	Number of elections (%)
They give a high quality education	49
On the advice of friends and relatives	38
I want to devote myself to work in the railway industry	30
Low admission contest, it was easier to enter the university	12
Closer to home than other universities	6
Moderate tuition fees	2

According to the data received, almost half of the students entering this university expect to receive a quality education in the first place. Also on the first academic day, students were asked if they had an idea about their future professional activity. To this question, 59% of first-year students responded that they were confident in their choice and knew their future professional activity well; 39% had a very vague idea of their chosen profession; 2% chose the options: "have not yet thought about professional activity, the main thing for me is to finish university" and "for me it is more important to get higher education in general than to evaluate the field of professional activity". Thus, we can state that the career guidance work with applicants is not effective enough and it needs to be improved. In our opinion, in order to further professional adaptation in the university it is necessary to conduct career guidance in such forms as specialty weeks, meetings with graduates and practitioners, trainings on career planning, etc. This will reduce the likelihood of professional disadaptation and the number of students leaving for other universities and areas of professional activity.

At the end of the first month of study at the institute a questionnaire survey of students was conducted in order to identify the difficulties they face in the first month of study at the university (the sample was 65 people). According to the data received, three groups of problems are the most difficult for students: lack of free time (48% of respondents), inconvenient schedule (34%) and overload of classes (26%). Thus, the most significant for first-year students is the problem of rational time planning. In our opinion, this explains the appearance of fatigue, tiredness, overwork in the first days of study at the institute, which was pointed out by 30% of the students surveyed.

In general, 95% of the students surveyed attend classes with interest, 19% note a cheerful state, 9% indicate a constant need to fight laziness, 6% experience boredom in the learning activities, and for 4% of respondents studying at the institute is associated with anxiety, worry.

Only 2% of respondents said that they had difficulties establishing contact with classmates, 82% said that they liked communicating with their classmates,

51% of students said that they had several friends in their group, and 49% of students considered themselves members of the collective.

In the middle of the first semester of study with the help of "Methodology of express-diagnostics of students' adaptation level to research and professional activity" the data on the adaptation level of KNUTD students were obtained (tab. 2).

Table 2

**The level of adaptation of KNUTD students
to research and professional activities**

Types of adaptation	Adaptation level (%)		
	high	medium	low
Social adaptation	15	59	26
Research adaptation	15	44	41
Professional adaptation	4	41	55

As can be seen from Table 2, low scores on the scale "Professional Adaptation" in more than half of the students (55%) indicate that the process of professional adaptation in the university is not given proper attention. Also a rather high percentage of low indicators is noted on the scale "Research adaptation" (41%). This indicates that many students find it quite difficult to take additional participation in research activities in the process of study, such students may need specially organized pedagogical support.

At this stage, we studied the relationship between the obtained adaptation indices and individual-typological properties of students' personality, which were assessed by means of the method "Individual-typological questionnaire". To establish the statistical relationship between the adaptation indices and individual-typological properties, Pyson's correlation coefficient was used. Table 3 presents the obtained correlation coefficients (statistically significant ones are highlighted in bold).

Table 3

**Relationship of adaptation indicators and individual-typological
features of KNUTD students**

Indicators	Social adaptation	Research adaptation	Professional adaptation
Extraversion	0,815*	-0,159	-0,293
Spontaneity	0,448	0,155	0,143
Innovativeness	0,056	-0,892**	-0,464
Creativity	0,305	-0,489	0,249
Introversion	-0,425	-0,069	0,025
Sensitivity	0,552	0,391	-0,291
Anxiety	0,438	-0,094	0,095
Lability	0,493	0,199	0,490

Notice: * $p \leq 0,05$; ** $p \leq 0,01$

Thus, statistically significant correlations were revealed in the following cases: positive correlation between the extraversion indices and the level of social adaptation (at the significance level of 0.05), and high negative correlation between the innovativeness and creativity indices (at the significance level of 0.01). No correlation between the indicators of professional adaptation and individual-typological qualities was revealed. The obtained data can be interpreted as follows: students of extraverted personality type adapt to the new social environment faster and easier, as they tend to show initiative in communication, they like to communicate with different people, in general they have social courage; lack of creativity negatively affects the indicators of research adaptation due to the fact that teachers often negatively perceive students' desire for self-assertion and independence, suppress manifestation of excessive a The absence of statistically significant indicators of correlation between individual-typological traits and professional adaptation can be explained by the fact that this type of adaptation is rather related to the motivational structure of the personality, its orientation, the presence of certain interests and inclinations, rather than individual-typological features.

In the middle of the second semester of the academic year 2020–2021, we conducted a study of the process of students' adaptation according to the "Methodology for studying students' adaptability in higher education to dual education" (Gryshchenko, 2015). The methodology includes two scales: adaptability to professional activity and adaptability to research activity. The data obtained through the methodology are presented in Table 4.

Table 4

**Adaptability level of students in higher education to dual education
(middle of the 2nd semester)**

Adaptability criterion	Level of adaptability, %				
	high	above average	medium	below average	low
To professional activity	4	54	18	25	0
To research activities	13	29	25	25	9

According to the data obtained, students with a low level of adaptation to professional activity were not identified. This indicates that students in general do not experience serious difficulties in employment and training practice, but a quarter of students (25%) still have a level of adaptation to professional activity below average. This shows that the professional activity at the moment is still in its formative stage, the norms and rules of interviews, internships, some students have not fully assimilated.

On the scale of adaptability to research activity the following results were obtained: 9% of students have a low level of adaptability, and 25% have a lower than average level. The data obtained indicate that more than 30% of students

have difficulty in mastering the basics of research work, need additional counseling; they have difficulty speaking in class, express their thoughts, they can not show their individuality and abilities.

The obtained results allow us to single out the following training areas: professional, social and research, as well as the stages of adaptation to professional training: learning identification, learning-professional activation, professional-value reflection. Integration of these directions allows us to organize activities that ensure the formation of students (graduates) with necessary professionally important qualities (competences), agreed with potential employers and demanded by the relevant profession.

We propose to implement the following activities in professional training in higher education institution:

- value (socio-moral) orientation of education aimed at self-development and self-improvement in professional activities;
- organization, management and pedagogical support of students' adaptation to professional activity;
- orientation of students on the value attitude towards research activity.

In the framework of this activity during professional training a graduate (student) forms readiness to work in new socio-economic conditions, which allows him/her to self-determine in the labor market and professions, to be ready to change professional functions, roles and even professions.

The conducted experiment on the basis of Hackathon-ecosystem of the university was carried out taking into account the directions of training and their corresponding adaptation criteria: professional direction – activity-result and motivation-value criteria; humanitarian – communication-professional criterion; research – personal-creative criterion.

The diagnostics included: questionnaire, testing, observation, interview, computer diagnostic methods for each criterion. During the diagnostics three assessment levels were used to assess the level of adaptation – low, medium, high. The quantitative composition of the experimental groups and the control group was determined by the present composition of specific study groups. Representativeness was achieved by random selection of four experimental groups and the control group. Each of the allocated directions was realized in one of the experimental groups, and in the fourth group a complex of all directions was realized. This allowed us to evaluate the impact of each of the selected areas on the adaptation of students of different courses to professional and research training. The statistical criterion χ^2 (chi-square) was used to compare the results of adaptation of different experimental groups.

Professional direction correlates with activity-result and motivation-value criteria, its indicators are the formation of the system of educational-professional knowledge, instrumental and analytical skills and the presence of professional

motivation. The results on the first criterion obtained during the entrance diagnostics show that the students have a low level of educational-professional knowledge, instrumental and analytical skills and availability of professional motivation. This is manifested in the fact that more than half of the students have a weak interest in the chosen profession and, as a consequence, low performance, which does not contribute to the development of their adaptive needs for professional training.

The implementation of the first activity direction allows to form motivational and value orientation of students to self-development in intellectual, professional and creative activity. The low level of formation of the system of educational-professional knowledge, instrumental and analytical skills among students has decreased from 38% to 19%, and the high level has increased from 15% to 35%. This reflects the positive influence of this direction on students' adaptation to professional training and formation of professional knowledge base as a value of professional activity.

The socially responsible direction corresponds to the communicative-professional criterion, its indicator is the formation of professional behavior and professional stability. This manifests itself in the inclusion of students in the system of public relations, during which the necessary professional qualities of personality are formed, communication skills and organizational skills in the professional environment are acquired. The results showed that the actual majority of students have a low level of perception of professional behavior and professional stability. The implementation of the second direction of the activity allowed to form students' communication skills, professional motivation taking into account professional traditions and value to the future profession. Diagnostics carried out at the end of the experiment revealed a positive impact of this direction on students' adaptation to professional training, the presence of professional motivation (low level changed from 33% to 18%, high from 14% to 31%, average almost unchanged).

The research direction corresponds to the personal-creative criterion, its indicator is the formation of students' value attitude to scientific knowledge and professional innovations. It is manifested in the ability of a future specialist to independently plan his/her lifestyle, organize research process, and take into account innovative factors of production environment. The implementation of the third direction allows students to form a value attitude towards professional health and safety. This was manifested in an increase in the number of students who are aware of the importance of scientific knowledge, the ability to rationally plan the research process. The results of diagnosis are as follows: low level changed from 33% to 20%; average from 52% to 56%; high from 15% to 24%, which suggests the presence of positive dynamics of students' adaptation to the research activity.

The obtained results show that the students of the experimental group, where the set of training areas was introduced, had the greatest positive dynamics of adaptation to professional training (the low level decreased from 29% to 11%, and the high level increased from 11% to 24%) compared to the three experimental groups. This is explained by the fact that most students were included in cognitive, creative and research activities, as well as in the socio-professional environment. The control group, formed by the principle of random selection of the same number of students from the three experimental groups, confirmed the reliability of the obtained results (low level decreased from 28% to 16%, and high level increased from 10% to 20%).

According to the results of the study we made the following conclusions:

- university adaptation is a process of active interaction of the student with the educational environment, the result of which is the change and development of personality, the formation of new adaptive behavioral strategies. University adaptation includes three interrelated components: socially responsible, research and professional;

- the majority of students have a focus on quality education and a vague idea about the content of future professional activity;

- in the first month of study at university students face difficulties in rational organization of their own time, which is subjectively accompanied by a feeling of fatigue and states of fatigue and overfatigue;

- in the initial period of study most students do not experience serious difficulties in communicating with their classmates. However, from the middle of the second semester a quarter of students note misunderstanding on the part of their classmates, which may indicate a crisis stage in the formation of the student group. Social adaptation is generally easier for students with pronounced extroversion traits;

- a significant part of the students experience difficulties in adapting to research activities (research adaptation) throughout the whole period of study, as evidenced by the test data conducted in the middle of the 1st and 2nd semesters. Moreover, the most difficulties in terms of research adaptation are experienced by students of independent personality, who show excessive activity and desire for self-assertion, in particular, by resisting the rules and not performing the proposed tasks, which is perceived by teachers as aggressiveness, which should be eliminated by reducing grades and toughening requirements.

The conclusions obtained in the course of the study can be used in the development of comprehensive programs of professional and research support for university students' adaptation.

CONCLUSION.

Diagnostic cuts to track the results showed: at the beginning of the experiment students had a low level of professional and research adaptation, at

the end of the experiment the number of students with a low level decreased by an average of 1.4 times, and those with a high level increased by an average of 1.9 times.

Thus, as a result of the study it was found that:

- organization, management and pedagogical accompaniment of students' adaptation to professional training is a system of interaction between university management, faculty and students, aimed at developing a unified concept of organizational and pedagogical accompaniment of the process of students' adaptation to professional training in the university in view of the socio-moral orientations of society;

- research adaptation includes the formation of students' value attitude towards science as a form of participation in intellectual and creative development. Comprehensive readiness of a specialist for professional training, for future professional activity includes physical, mental, psychophysiological well-being, sufficient professional work capacity and safe interaction skills in the rapidly changing socio-professional sphere. Adaptation of a university graduate to future professional activity is a process of formation of integral, mature personality of a future specialist-professional. The process of adaptation includes the formation of scientific and professional knowledge, development of communicative skills and ways of interaction in professional environment, formation of social and moral attitudes to professional health and safety. The results of adaptation manifest themselves in the value orientation of the graduate for self-realization and self-development, which ensures his/her competitiveness and mobility in the labor market.

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ABBREVIATIONS:

<i>Eq.</i>	Equation
<i>fig.</i>	Figure
<i>HEI</i>	Higher education institution
<i>HETT</i>	Hackathon Ecosystem of Technology Transfer
<i>KNUTD</i>	Kyiv National University of Technologies and Design
<i>MES</i>	Ministry of Education and Science in Ukraine

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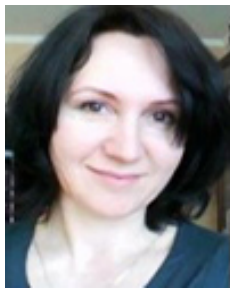
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DIAGNOSIS WITH THE HACKATHON ECOSYSTEM OF THE UNIVERSITY OF THE READINESS OF STUDENTS FOR RESEARCH ACTIVITIES

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BACKGROUND AND OBJECTIVES.

The changes in society associated with the country's transition to an innovative way of development radically change the nature and goals of labor activity. Profession under such conditions is considered by a person as a source of material well-being and gaining the desired social status. Professional self-determination occurs too late or is realized as forced, so the lack of opportunity to realize one's professional preferences has a negative impact on the individual and on society as a whole. As a result, in recent decades there has been a significant increase in the requirements of modern employers to the professional training of graduates of educational institutions. A young specialist must improve in the profession, be ready to change professional activity, i.e. be socially and professionally mobile, scientifically established, which can be realized with the help of Hackathon-ecosystem.

METHODS. Collection of information, survey of students and teachers were carried out using a systematic approach on the basis of the Hackathon ecosystem. Processing of the obtained information, definition of scientific statements, generation of conclusions and practical

recommendations were carried out with the help of the software product "Methodology of studying students' adaptation to dual education in higher education".

FINDINGS. It is proved that the research activity of students is a necessary condition for their professional self-determination, acts as part of a holistic, long-term, dynamic process of entry into the profession and as a result of the choice and design of their future professional activity. Students' involvement in research activity largely determines the effectiveness of their social and professional development.

CONCLUSION. Research activity of university students is an effective means of forming knowledge, abilities and skills necessary for personal and professional self-determination. It not only stimulates and motivates personal and intellectual development, contributes to the continuation of education, proves the degree of its readiness and acts as one of the guarantors of the success of the process of professional self-determination in general.

KEYWORDS: Hackathon ecosystem; research readiness; students; technical university.

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15	1	0

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ДІАГНОСТИКА ЗА ДОПОМОГОЮ ХАКАТОН-ЕКОСИСТЕМИ УНІВЕРСИТЕТУ ГОТОВНОСТІ СТУДЕНТСЬКОЇ МОЛОДІ ДО НАУКОВО-ДОСЛІДНОЇ ДІЯЛЬНОСТІ

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ПОСТАНОВКА ПРОБЛЕМИ ТА ЗАВДАННЯ. Зміни у суспільстві, пов'язані з переходом країни на інноваційний шлях розвитку, кардинально змінюють характер та цілі трудової діяльності. Професія за таких умов розглядається людиною як джерело матеріального благополуччя та набуття бажаного соціального статусу. Професійне самовизначення відбувається занадто пізно чи усвідомлюється як вимушене, тому відсутність можливості реалізувати свої професійні уподобання негативно позначається на особистості та суспільстві в цілому. І як результат, останні десятиліття відзначається значне зростання вимог сучасного роботодавця до професійної підготовки випускника навчального закладу. Молодий фахівець повинен удосконалюватися у професії, бути готовим до зміни професійної діяльності, тобто бути соціально та професійно мобільним, що науково відбулося, що може бути реалізовано за допомогою Хакатон-екосистеми.

МЕТОДИ. Збирання інформації, опитування студентської молоді та викладачів здійснювалися з використанням системного підходу на базі Хакатон-екосистеми. Обробка отриманої інформації, визначення наукових положень, генерування висновків та практичних рекомендацій

здійснювалося за допомогою програмного продукту «Методологія вивчення адаптації студентів до дуальної освіти у вищій школі».

РЕЗУЛЬТАТИ. Доведено, що науково-дослідна діяльність студентської молоді є необхідною умовою їхнього професійного самовизначення, постає як частина цілісного, тривалого, динамічного процесу входження у професію та як результат вибору та проектування ними майбутньої професійної діяльності. Включеність студентів до дослідницької діяльності багато в чому визначає ефективність їх соціального та професійного становлення.

ВИСНОВКИ. Науково-дослідна діяльність студентської молоді вузу є ефективним засобом формування знань, умінь та навичок, необхідних для особистісного та професійного самовизначення. Вона не тільки стимулює та мотивує особистісний та інтелектуальний розвиток, сприяє продовженню освіти, доводить ступінь її готовності та виступає як один із гарантів успішності проходження процесу професійного самовизначення в цілому.

Ключові слова: Хакатон-екосистема; готовність до науково-дослідної діяльності; студентська молодь; технічний університет.

INTRODUCTION.

Intense processes taking place in the economic, political, and social spheres of modern Ukrainian society inevitably affect education. Higher professional school of Ukraine is undergoing a multi-vector process of renewal. One of the main goals of transformation is a comprehensive training of a specialist, capable of professional growth and self-development, who is ready to conduct scientific research in a particular field of knowledge.

It is not enough for a modern graduate just to have deep subject knowledge and possess practical abilities and skills. One of the actual directions of development of the educational process of higher education institution is the formation of students' readiness to research activities.

The analysis of the scientific literature shows that various aspects of the problem of students' readiness to research activities are considered by a number of teachers and researchers (Linnell et al., 2014). This problem is not new, but even today it does not lose its relevance and acuteness.

The problem of formation of students' readiness to research activities can be solved using different methodological approaches (modular, anthropocentric, differential, synergetic, culturological, etc.).

From our point of view, in the current socio-economic and political conditions of higher education development, the application of competency-based approach to solve this problem is the most effective and expedient.

The competence approach in determining the goals and content of education is not qualitatively new in the domestic system of education. I. Gryshchenko notes that the competence approach is "an approach that focuses on the result of education, and the result of education is not the amount of information learned, but the ability to act in various problem situations" (Gryshchenko, 2015).

In the draft of the new state standards of higher professional education the notion of "competence" was introduced as a more complete, personally and socially integrated result of specialists' training.

Following T. Zhurko, we consider competence as "a set of personal qualities (knowledge, abilities, skills, value and meaning orientations) which are conditioned by activity experience and provide efficiency of independent activity" and competence as "a form of presentation of normative requirements to the results of educational practice from the position of personal qualities of students" (Zhurko, 2016).

Comprehensive consideration of the issues raised in our study through the prism of competence approach implies consideration of such notions as "research activity of students", "research competence and competence".

Among the many interpretations of the concept "research activity of students" found in the scientific literature, the most accurate, in our opinion, is

the definition of J. Yao, H. Li, D. Shang, L. Ding, who understand this type of activity as "a type of creative, cognitive activity aimed at students' mastering of independent theoretical and experimental work, modern methods of scientific research, experimental techniques" (Yao et al., 2021).

Research activity of students, like any human activity, should be socially conditioned and significant, its content cannot be arbitrarily designed, invented. It must meet the socially recognized forms, methods and norms of scientific research.

A number of researchers note that the level of readiness of a university student to research activity can be considered as an objective indicator of his/her professional competitiveness. In particular, G. Yildizer considers professional competitiveness of students as "the ability to achieve success in professional activities under competitive conditions on the basis of professional competence and mobilization of the resource of individual-personal qualities" (Yildizer, 2017). Undoubtedly, a high level of students' readiness for research activities is an integral guarantee of their success in professional activities.

In agreement with V. Scherbak, S. Arabuli, research competence of students will be considered as "an integrative characteristic of a personality, interpreted as its property or quality, characterizing student's readiness to solve research problems by methods of scientific knowledge and expressed in the unity of value-motivational, cognitive and operational components of student's personality" (Scherbak and Arabuli, 2021).

In turn, research competence of students is considered "as a set of intellectual, personal and activity characteristics of the student, (N. Krakhmalova) implemented in the productive research activities" (Krakhmalova, 2021).

When describing activity competences (I. Goncharenko) uses the concept of "readiness" interpreted as "the actual and realizable ability to perform actions-operations of a certain kind" (Goncharenko, 2021).

P. Dudko considers the research work of student youth on the basis of innovative enterprises in the broad context of information space, where the activity itself acts as a process of student activity (Dudko, 2021).

P. Dudko singles out the following components of students' research work: informational (getting information about already existing knowledge, generalizing this knowledge, fixation); analytical-critical (analysis and criticism of existing knowledge, setting the research problem based on revealing partially or completely unidentified sides of research topic); research proper (conducting theoretical and experimental research to get new knowledge, fixation of intermediate research results); translational-ophobic (research on the subject).

Today a lot of attention is paid to the training of technical personnel. The country desperately lacks engineers, and those who are able and want to become

engineers need to be provided with decent training conditions. After all, in the conditions of market competition and modernization of the country the leading role in innovative development of Ukraine belongs to science-intensive and high-tech industries. A modern engineer should combine the talents of a scientist, a designer and a manager, be able to unite specialists of different profiles for joint work, i.e. have a certain set of competences. It is the social order of the society to higher education, which is the basis of the National State Educational Standards for Higher Professional Education.

According to the standards, the objective of higher education is to provide students with a set of general cultural and professional competencies. The professional competencies (L. Hanushchak-Yefimenko, 2021) imply readiness to perform the following types of professional activities: design and development, production and technological, research, organizational and managerial, installation and commissioning, service and maintenance. Among these types of professional activity the research and development activity is of particular importance. This is evidenced by the Concept of long-term socio-economic development of Ukraine for the period up to 2030, which notes that "one of the main conditions for the development of higher professional education system is the involvement of students and teachers in fundamental and applied research", which will allow "not only to maintain the world-known Ukrainian scientific schools, but also to raise a new generation of researchers, focused on the needs of innovative knowledge economy" (Hanushchak-Yefimenko, 2021).

Consequently, the research activities of student youth will be understood as a type of creative, cognitive activity associated with the search for solutions to problems with a previously unknown result. The peculiarity of the process of research activity of student youth is an individual approach to the creative self-realization of each student. The result of research activities of student youth is an intellectual product, which includes new knowledge; development of critical thinking, cognitive activity, independence, initiative in learning (Lopatenko, 2016).

Based on the analysis of scientific literature, the essence of the concept of "students' research activity" we formulated the definition of "students' readiness for research activity", which we consider as a personal formation that determines the state of personality of the subject and includes motivational and value attitude to this activity, system of methodological knowledge, research skills, allowing their productive use in solving emerging professional and pedagogical tasks.

The aim of the article is to substantiate the technology Hackathon-ecosystem for diagnosing the readiness of student youth to research activities. The study was by interviewing students and teachers, processing the results in Kyiv National University of Technologies and Design (KNUTD) in 2021.

MATERIALS AND METHODS.

To survey students on the degree of their readiness for research activities, the tools of the University Hackathon Ecosystem were used. To collect and process the obtained information, the "Methodology for studying students' adaptation to dual education in higher education" was used (Gryshchenko, 2015).

RESULTS AND DISCUSSION.

The structure of students' readiness for research activity includes the following interrelated components: motivational, characterizing cognitive interest, motivation of research activity; orientational, including ideas about the methodology of scientific research and ways of research activity; activity, determining the possession of skills and abilities of research activity; reflexive, including self-assessment and self-analysis of own research activity. The degree of formation of each of these components is an objective indicator of the level of readiness of the future specialist to research activities within their specialization.

In accordance with the defined components the following criteria were developed: motivational, orientational, activity, reflexive.

Based on the developed criteria we determined the levels of students' readiness to research activities:

- high level is characterized by understanding the importance of research activities, interest in research activities, possession of the logic of scientific research, the ability to independently plan their own research work and implement it, the ability to analyze their own activities and identify ways and ways of self-development;

- the average level is characterized by a superficial understanding of research activities, lack of skills in research activities, unstable interest in the studied disciplines and research activities, incomplete possession of basic knowledge and skills, desire for self-education, but not always adequate assessment of own activity;

- low level is characterized by unstable interest in the studied disciplines, lack of understanding of social and personal significance of research activity, inability to work with literature, see the problem, identify contradictions, inability to build the logic of research independently, insufficient satisfaction with own activity, minor reflection of own activity, not always adequate self-assessment, fragmented self-analysis.

To study the qualitative side of students' readiness for research activities, a study was conducted with the participation of 155 students of Kyiv National University of Technologies and Design.

At this stage, control and experimental groups were formed. The control group included the students of the specialty "Entrepreneurship in the hotel and restaurant business" consisting of 70 people, the experimental group included the students of the specialty "Design" consisting of 75 people.

At the ascertaining stage of the experiment the questionnaire "Determination of the level of readiness of university students to research activity" was developed, also for the analysis of the motivational component of readiness the methodology "Methodology of studying students' adaptation to dual education in higher school" was offered to the respondents (Gryshchenko, 2015).

The results of the ascertaining stage of the experiment showed that 70% of students have significant difficulties in the organization of research activities; 75% of respondents believe that the university created not enough conditions to stimulate the motivation of students to engage in research activities. In addition, 75.5% of the students have a low level of readiness for research activities, 16.2% – average, and only 7.5% – high.

The analysis of the results of the conducting stage of the experiment led to the conclusion about the necessity of complex formation of students' readiness for research activities, search of forms and methods of additional stimulation of students' motivation for scientific research activity.

Formation of students' readiness of KNUVD for research activities is carried out in the form of creating an additional course for students ("Fundamentals of research digital activities"); inclusion of the research component in existing courses; involvement of students in the development and implementation of research projects in the online system; hearing reports of students on the results of the digitalization of their research, discussion of each report.

The research work of students in the university can be divided into academic research work of students and extracurricular research work, which, in turn, includes the research work that complements the educational process, and research work parallel to the educational process (Hanushchak-Yefimenko, 2021).

Student research work is an activity, which is determined by the curriculum and work programs, creates the prerequisites for the involvement of students in active research work. Educational and research work of students assumes high activity and independence of students in the learning process, which contributes to a deeper mastering of the program material, acquiring not only a certain amount of knowledge, but also sustainable skills of their practical application.

Extracurricular research work is directly related to the educational process, but takes place in extracurricular time and has a qualitative specificity, relative independence and its own logic. Its features are that it is based on the principles of independence and voluntariness of students and brings together students of different faculties, specialties, courses and levels of training.

The main objective of extracurricular research work, supplementing the educational process is to go beyond the curriculum, individualization of the educational process, the creation of prerequisites to ensure the continuation of postgraduate studies.

The purpose of extracurricular research work, parallel to the educational process, is the scientific professionalization of students under the guidance of teachers and researchers.

Due to the specifics of universities different types of research work of student youth are possible. for technical universities certain types of research work of student youth are the most characteristic, presented in figure 1.

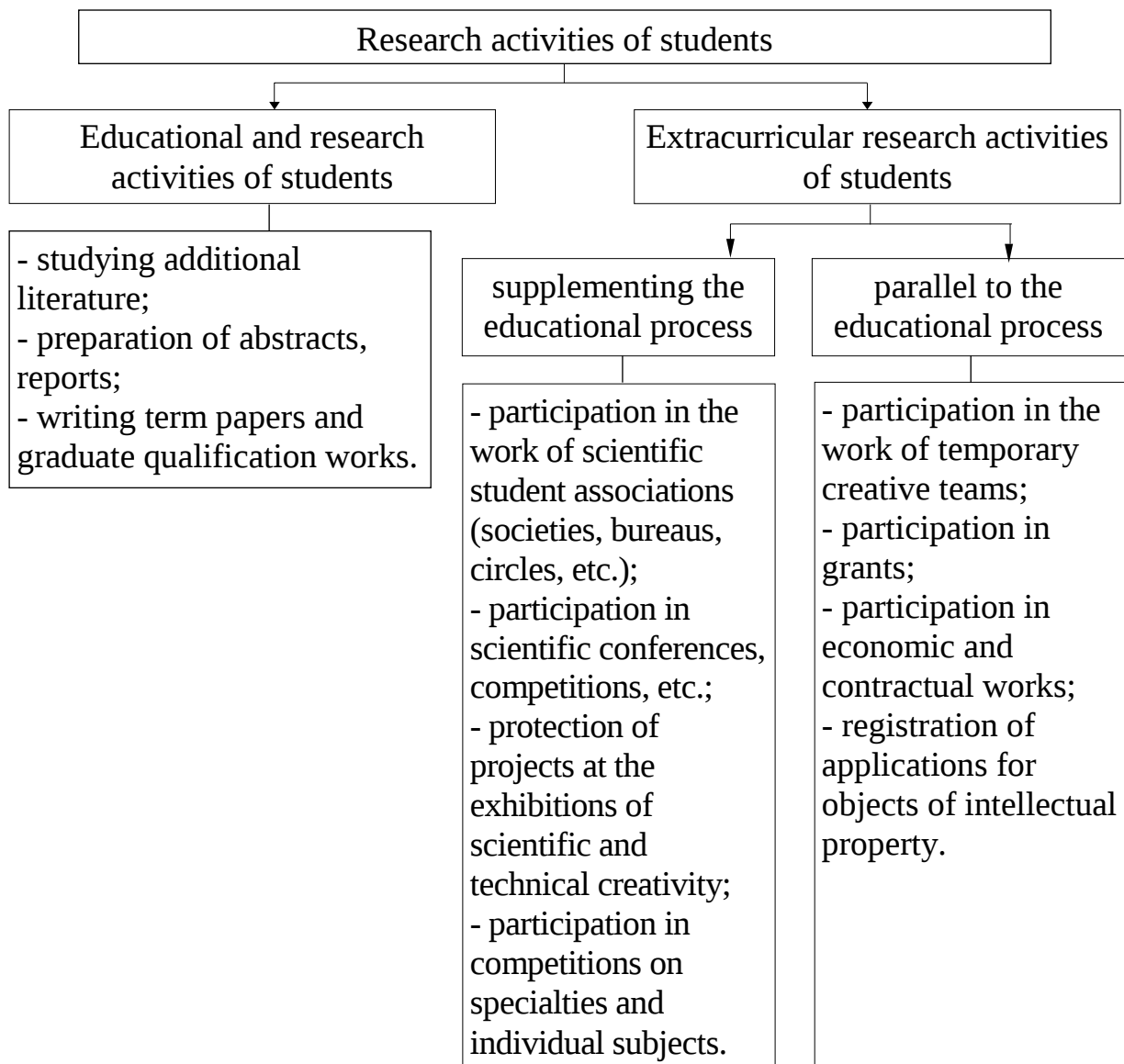


Fig. 1. Types of research activities of student youth in a technical university

Research activity of students is realized through the performance of course and diploma projects, participation of students in scientific-practical conferences, competitions of students' scientific works, in business games in the form of debates of various formats, in the Olympiads of various levels.

Undoubtedly, a special role in the formation of this type of readiness is played by professional activities of the teacher, academic supervisor, who contribute to the successful mastering of students' skills and abilities in research activities.

Teachers' activities include supporting educational activities of students in basic education, identifying and analyzing the level of students' readiness for research activities, creating opportunities for students to implement scientific research (setting, assistance in choosing and solving research problems); conducting individual consultations, stimulating students' motivation; analysis of teaching activities and results of interaction with students.

Students' activities integrate mastering of social experience as provided by the educational standard, and necessary to set, solve, present and self-analyze the results of their own research activity.

The activities of teachers and students mutually influence each other, reflecting the parity in the relationship between the teacher and the student: correction with the student is carried out, the teacher plans the content of professional training in accordance with individual and personal characteristics of the student.

The effectiveness of the proposed measures for the formation of university students' readiness for research activities is confirmed by the results of the re-study experiment (control section), conducted at the end of the experimental work. The number of students with a low level of readiness for research activities in the experimental group decreased by 55.5%, in the control group by 15.5%; the number of students with an average level of readiness in the experimental group increased by 27.5%, in the control group by 11.2%; the number of students with a high level of readiness for research activities increased by 27%, in the control group by 5.2%. The results of the experiment were mathematically processed using Fisher's multifunctional criterion.

Analyzing the results obtained in the experimental and control groups, it should be noted that positive shifts in the levels of students' readiness for research activities occurred in both the experimental and control groups. This means that even within the traditional teaching methodology there is an increase in the level of students' readiness for research activities as they accumulate experience in learning and research work. However, this process proceeds less intensively than in the experimental group, where a set of activities, contributing to the successful formation of the readiness of university students to research activities is introduced.

Thus, the study carried out with the help of Hackathon-ecosystemy university toolkit confirmed the effectiveness of the highlighted set of measures for the formation of university students' readiness for research activities.

It can be concluded about the effectiveness of the competence approach to the comprehensive solution of the problem of our research.

The competence-based approach prioritizes not informativeness, but the ability to solve problems arising in standard and non-standard situations of professional activity. It is characterized by both strengthening of pragmatic and humanistic orientation of the educational process in higher education.

Analysis of different types of research work shows that in a technical university scientific activity forms the student's skills both in speaking in a large audience to attract attention to his work (conferences, exhibitions, etc.) and in painstaking search of literary and reference sources to develop new technical solutions. This allows, on the one hand, to gain experience in design activity, and on the other hand, to lay the foundations of leadership and management skills. That is why it is necessary to begin to intensify research work from the first days of higher education, and the key role here should be given to the teaching staff.

Requirements for the level of formation of professional competencies in the field of research activities are presented in the University Hackathon Ecosystem. In order to identify the content of professional competencies of a technical university student, an analysis was conducted with the help of the University Hackathon Ecosystem tools for the following undergraduate training areas: "Entrepreneurship in the Hotel and Restaurant Business", "Design". Student's professional competencies in research activities include:

- readiness to create, master and provide quality of new techniques;
- ability to apply progressive production technologies;
- readiness to take part in scientific research;
- ability to draw up the results of research in the form of articles and reports at scientific-technical conferences, competitive works;
- ability to organize protection of intellectual property rights (inventions, utility models, industrial designs, computer programs and databases);
- creation of a portfolio of innovations and innovations.

Consequently, the process of forming professional competencies of technical university students in the field of research activity will be effective if the university creates conditions for the development and improvement of scientific creativity of young people: organizational, methodological, material and technical. In our opinion, the most important of these conditions is the presence of a certain infrastructure in the university, providing concentration of labor, material, financial and other resources, preservation and strengthening of basic, determining nature of science for the development of higher education, attracting young researchers to scientific activity (students of schools, lyceums, technical schools, students and graduate students).

There are different structural divisions in Kyiv National University of Technologies and Design responsible for different directions of scientific-

research work. For example, the departments are responsible for scientific research work that includes studying additional literature, preparing reports and essays, writing term papers and graduate qualification works. The student research society, research training department, youth innovation and technology center, intellectual property sector, the center of educational-scientific-innovative activity involve students in extracurricular research work. Moreover, these structural units supervise certain types of extracurricular research work. Student Scientific Society and Department of Scientific Workforce Training stimulates the participation of students in scientific conferences, competitions, contests on specialties and individual subjects and exhibitions of scientific and technical creativity of young people. Technology Transfer Department ensures the participation of students in grants for youth support, innovation forums. Sector of Intellectual Property involves students in the creation of intellectual property objects (inventions, utility models, industrial designs, computer programs and databases).

Organization of scientific-innovation activity of students in KNUTD includes several stages. At the first stage students of the 1st and 2nd years are involved in the annual student scientific and practical conference "Actual problems of science and education". The specifics of this conference is that senior students act as research supervisors of junior students. In addition, at this stage the essay contest "Science in my life", "Intellectual marathon", the university round of the contest for the best scientific work of students are held. The second stage involves the inclusion of the most active students in the student scientific society. At the third stage students who take an active part in scientific-innovative activity choose the direction of scientific research in which they will be engaged in the future. The fourth stage is characterized by students' participation in competitions of research works, Olympiads on specialties and individual subjects, students' involvement in inventive and patent-licensing activity. At the fifth stage publications of students in collections of scientific works, participation in exhibitions of KNUTD are carried out. The sixth stage foresees participation of students in competitions of international and all-Ukrainian grants, in youth innovative forums. The seventh stage opens the prospect of entering graduate and postgraduate programs and the opportunity to subsequently stay to work as teachers in the departments at the university.

CONCLUSION.

The result of the organization of research work in KNUTD, based on the competence approach using the tools of the University Hackathon ecosystem, is the positive dynamics of the formation of professional competencies in the field of research and innovation activities, expressed in an increase in such indicators as:

- the number of students who participated in research and innovation activities;

- the number of exhibits presented at the exhibitions with the participation of students;
- the number of intellectual property objects created in co-authorship with the faculty;
- number of prizes, awards and diplomas received by students by the results of participation in the events of regional, national and international levels.

Thus, research and innovation activity is an integral part of successful training of university students, having a positive impact on the formation of professional competencies. Its performance indicates the degree of students' readiness for further research and innovation activity.

ACKNOWLEDGEMENT.

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CONFLICT OF INTEREST.

There is no conflict of interest.

ABBREVIATIONS:

<i>Eq.</i>	Equation
<i>fig.</i>	Figure
<i>HEI</i>	Higher education institution
<i>HETT</i>	Hackathon Ecosystem of Technology Transfer
<i>KNUTD</i>	Kyiv National University of Technologies and Design

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SMART GRID ENERGY CONSERVATION MANAGEMENT BASED ON THE UNIVERSITY'S ENERGY INNOVATION HUB OF KNOWLEDGE

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BACKGROUND AND OBJECTIVES.

Due to increasing energy costs, as well as strict environmental regulations, there is a growing need for greater resource efficiency, which makes energy-efficient solutions necessary. Thus, the importance of innovations based on technologies designed to save energy, such as the Smart Grid, is increasing. Smart Grid is not just a compilation of smart meters or other electrical devices, it is a series of technologies, a concept of a fully integrated, self-regulating and self-healing power grid, which has a network topology and includes all sources of generation, transmission and distribution, managed by a single network of information and control devices and systems.

METHODS. As the main method used was the calculation of the synthetic balance of savings from the use of different types of energy resources by the university after the implementation of the application Smart Grid-energy conservation management on the basis of the university energy-innovation Hub of knowledge.

FINDINGS. A mechanism for the implementation of the Smart Grid energy-

saving management application on the basis of the university energy-innovation Knowledge Hub is proposed. Smart Grid is designed to provide real-time data on the almost instantaneous balance of energy supply and demand. To ensure grid reliability by reducing peak demands and improving energy efficiency, Smart Grid data management is an affordable and effective tool for data analysis and decision making.

CONCLUSION. The results of calculation of the predicted effect of the Smart Grid application implementation for the 4th building of Kyiv National University of Technologies and Design proved that the reduction of installed capacity as a result of the project was 80.5%, i.e. a 1% reduction in capacity creates an economic effect of 0.58% of the costs associated with modernization. Given the current level of electricity consumption, we can predict a potential reduction of 951 thousand UAH per year or almost 50% of the cost of electricity consumed in 2020.

KEYWORDS: Smart Grid energy conservation management; Energy Efficiency Knowledge HUB; University.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
16	1	2

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**SMART GRID-УПРАВЛІННЯ
ЕНЕРГОЗБЕРЕЖЕННЯМ НА БАЗІ
УНІВЕРСИТЕТСЬКОГО
ЕНЕРГОІННОВАЦІЙНОГО ХАБА ЗНАНЬ**

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ПОСТАНОВКА ПРОБЛЕМИ ТА ЗАВДАННЯ. У зв'язку зі зростаючими енерговитратами, а також суворими екологічними нормами, зростає потреба у підвищенні ефективності використання ресурсів, що унеможливує енергоефективні рішення. Таким чином, збільшується значущість інновацій, що базуються на технологіях, призначених для енергозбереження, таких як Smart Grid. Smart Grid - це не просто компіляція інтелектуальних лічильників або інших електричних пристроїв, це ряд технологій, концепція повністю інтегрованої, саморегульованої та самовідновлюваної мережі електроживлення, яка має топологію мережі і включає всі джерела генерації, передачі та розподілу, керовану єдиною мережею інформаційних та керуючих пристроїв та систем.

МЕТОДИ. Як основний метод використано розрахунок синтетичного балансу економії від використання різних видів енергоресурсів університетом після впровадження програми Smart Grid-управління енергозбереженням на базі університетського енергоінноваційного Хаба знань.

РЕЗУЛЬТАТИ. Запропоновано механізм імплементації програми Smart Grid-управління енергозбереженням на

базі університетського енергоінноваційного Хаба знань. Smart Grid призначена для надання даних у режимі реального часу про майже миттєвий баланс енергопостачання та попиту. Для забезпечення надійності енергомережі шляхом зниження пікових вимог та підвищення енергоефективності, управління даними, що використовуються для роботи та обслуговування системи Smart Grid, є доступним та ефективним інструментом аналізу даних та прийняття рішень.

ВИСНОВКИ. Результати розрахунку прогнозного ефекту від впровадження програми Smart Grid для 4 корпусу Київського національного університету технологій та дизайну довели, що зниження встановленої потужності в результаті реалізації проекту становило 80,5%, тобто зменшення потужності на 1% створює економічний ефект у розмірі 0,58%. витрат, пов'язаних із модернізацією. З огляду на існуючий рівень електроспоживання можна прогнозувати потенційне скорочення витрат на 951 тис. грн за рік або майже 50% від вартості спожитої у 2020 році електроенергії.

КЛЮЧОВІ СЛОВА: Smart Grid-управління енергозбереженням; ХАБ знань з енергоефективності; університет.

INTRODUCTION.

Energy and resource saving is one of the important tasks in modern production and public policy of many countries (Di Stefano, 2000). Heat and electric energy consumption is the most important condition for human survival and development of Ukrainian economy, including creation of favorable and comfortable living conditions (Gryshchenko et al., 2017). As noted by many specialists and experts, increasing the competitiveness of Ukrainian enterprises and ensuring their economic and energy security is impossible without the implementation of large-scale projects in the field of energy conservation and energy efficiency (Kaplun and Shcherbak, 2016).

According to the state program of Ukraine "Energy saving and increasing of energy efficiency for the period up to 2030" the following barriers hindering the development of energy saving and energy efficiency in the country can be identified, which are represented as four groups of factors:

- lack of motivation;
- lack of information;;
- lack of experience in financing projects;
- lack of organization and coordination.

Objective tendencies of modern economy development testify to increasing competition between enterprises and organizations for all types of resources. Under the conditions of constant growth of the energy component in the costs of production and services, energy resources management – energy management (Liu et al., 2019) acquires special relevance.

According to modern representations of a management science energy management represents management of energy as any other industrial resource with the purpose of decrease in expenses by improvement of power efficiency (Shaposhnikova and Shimov, 2016). In energy management the issues of energy efficiency are considered not only from the standpoint of technical aspects of energy supply and energy saving, but also from the standpoint of organizational, motivational, informational, marketing and investment aspects (Fig. 1). These aspects, along with technical issues, are the components of energy management (Shcherbak et al., 2019). The most important elements of energy management should also include the energy policy of the enterprise (Scherbak, 2021).

Modern concepts of energy resources management are based on the provisions and methods of the theory of energy management (Vieira et al., 2020). Necessity of application of energy management is caused by a steady tendency of growth of an energy component in structure of expenses for manufacture of production, rendering of services. Decrease in power expenses due to effective power management leads to a number of advantages: increase in profitability, preservation of workplaces, additional monetary sources for

investment, greater competitiveness and increase in economic stability of the enterprise (Xing et al., 2019).

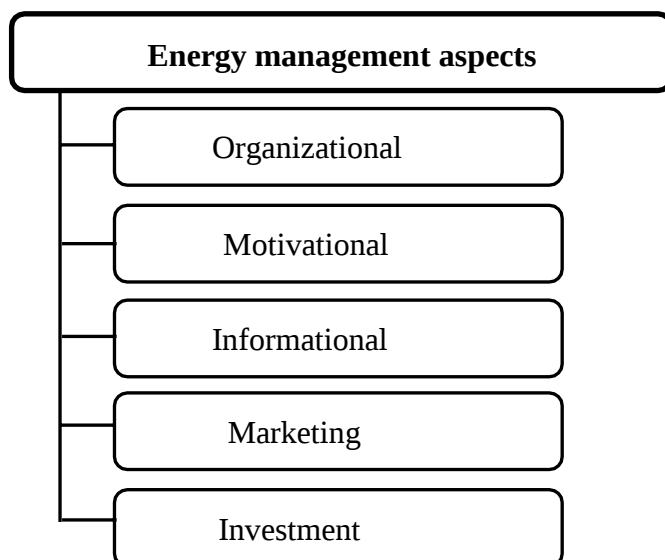


Fig. 1. The main aspects of energy management

Energy saving is understood as the process of reducing energy consumption by increasing the efficiency of energy use. The size (effect) of energy saving at the enterprise is defined by a difference of expenses in physical or economic units before introduction of measures on increase of efficiency of use of energy and fuel resources and after their introduction. One of the key concepts of energy saving is the energy saving potential, which means the amount of fuel and energy resources by which their consumption can be reduced as a result of implementing energy saving policies and practices.

Today, the ideology of the development of complex and stressed electric power systems in the world has become the concept of smart grid development. This is determined by the fact that the development of electric networks by simply increasing the capacity even with the use of modern equipment, as recognized in the world, has no prospects (IIASA, 1995).

Fundamentally new in the use of energy efficiency is the introduction of the concept of Smart Grid. It has a special, leading role of the core of the power system – the electric grid, which in the power system unites everything and coordinates everything (EN 13790:2008). In addition, the network itself is fundamentally new in its ability not only to adapt, which has long been laid down not only in energy systems, but also in the form of self-tuning. This is a new level of networks and an important step towards turning them into intelligent, intelligent networks (www.telesystems.info, 2010).

In the world today great efforts are made to develop intelligent systems. State structures, energy companies in most countries of the world consider the concept of Smart Grids as an ideology of national development programs of electric power industry as a basis for innovative modernization and transformation of electric power industry (ISO 50001:2011). Individual elements of Smart Grid – smart grids are actively implemented abroad, as well as work on their comprehensive application is in progress.

The use of "smart grids" in energy management of the university has the following components:

- improving the efficiency of transportation and distribution of electricity;
- encouraging consumers to save energy and reduce their energy costs;
- integration of different "smart" components into an "intelligent" power system;

- supporting the development of technologies for "smart" energy systems (Safiulina et al., 2010).

The purpose of the study is to propose a mechanism for the implementation of Smart Grid energy conservation management application on the basis of the university energy-innovation Knowledge Hub. The study was conducted in 2021 to analyze the possibility of Smart Grid energy conservation management application on the basis of university energy-innovation Knowledge Hub in Kyiv National University of Technologies and Design (KNUTD).

MATERIALS AND METHODS.

The synthetic balance of savings from the use of different types of energy resources by the university (<http://www.cenef.ru/file/indications.pdf>) after the implementation of the Smart Grid energy-saving management application on the basis of the university energy-innovation Knowledge Hub is determined by equation:

$$\sum_{i=1}^n k_{fi} \cdot V_{fi} + k_{ep} \cdot W_{ep} + k_{he} \cdot Q_{he} = \sum_{i=1}^n \sum_{j=1}^L V_{fij} + k_{ep} \cdot \sum_{j=1}^L W_{epL} + k_{he} \cdot \sum_{j=1}^L Q_{heL} \quad (1)$$

where V_{fi} is the amount of purchased fuel of the i -th type;

k_{fi} is the equivalent of conversion of fuel of the i -th type into conditional fuel;

n is the number of types of fuel used;

W_{ep} – purchased electricity;

Q_{he} – received heat energy; V_{fij} is the amount of fuel of the i -th h type consumed by the j -th structural subdivision of KNUTD;

k_{ep}, k_{he} – heat equivalents of conversion into conditional fuel, respectively, of electric and thermal energy;

W_{epL}, Q_{heL} – amount of consumed electric and thermal energy;

L – number of structural divisions of KNUTD.

RESULTS AND DISCUSSION.

Smart Grid platform for further implementation, including:

- flexible, optimal and strategically rational development of unified energy systems and management of its functioning;
- flexible management of electricity consumption, active on the consumer side;
- targeted provision of power quality and reliability of power supply for specific power consumers;
- coordination of local control systems and complete integration of renewable power sources and distributed generation in unified energy systems;
- extensive development of small dispersed generation that connects near consumers;
- harmonization of legislation to ensure cross-border trade in electricity and electric power services.

As a result of implementing the Smart Grid technology platform, the electric grid must acquire the following features: flexibility in terms of responding to changes in consumer needs and possible problems with power supply; availability of electricity to consumers, in particular from renewable energy sources and highly efficient local generation with zero or low emissions; reliability of power supply and power quality in the computer age while ensuring the avoidance of hazards and uncertainties; cost-effectiveness z

As part of the Smart Grid concept, the implementation of this platform in the university's energy efficiency system develops the following properties of electric power:

1. Self-recovery in case of emergency perturbations. The power system and its elements constantly maintain their technical condition at the required level through risk identification, analysis, and transition from management after a disturbance to prevention of emergency damage to network elements.

2. Motivating active behavior of the end consumer. Consumers acquire the ability to independently modify the volume and consumer characteristics of energy (reliability level, quality etc.) based on the balance of their demands and the power system capabilities, using information on pricing parameters, generation volumes, power supply reliability etc.

3. Counteracting negative impacts. Using special methods to reduce physical and informational vulnerability of all energy system components and contributing to both prevention and fast restoration after accidents, in accordance with energy security requirements.

Ensuring reliable power supply and power quality in different price segments. Transformation of System based approach into Customer based approach.

Optimal integration of generating and storage capacities in the energy system, connection by means of standardized procedures of technical connection and implementation of microgrids at the user level allows:

1. Expand capacity and energy markets, including to the inclusion of end users. To open access to the power markets of the so-called active consumer and dispersed generation in order to improve the efficiency and effectiveness of the retail segment.

2. To optimize asset management, switch to remote real-time monitoring of the functioning of production assets; integrate such monitoring into corporate management systems to increase efficiency, improve operating processes, repair, replace equipment and, consequently, reduce costs.

To create a new innovative technological basis for the XXX century power industry, five groups of basic technological areas were formed in the Smart Grid concept, providing a breakthrough nature of changes:

- gauges and devices;
- advanced control systems, containing dispersed intellectual devices and analytical tools for supporting communications at the level of power system objects, working in real time; new generation operating systems (SCAD/EMS/NMS systems), allowing the use of new algorithms and methods of grid control, including its active elements – first of all, flexible AC transmission systems FACTS;

- advanced technologies and components of the electrical network, in particular FACTS, superconducting cables, power electronics elements, etc.;

- integrated interfaces and decision support systems, such as SCADA system, demand management system, dispersed monitoring and control system (DMCS), dispersed current generation process control system (DGMS), automatic current process measurement system (AMOS); new IT solutions for the design and planning of power system elements;

- integrated communications, ensuring the interconnection of the first four technological groups and guaranteeing an innovative level of network operation. Such integrated communications include: automated substations based on modern integrated hardware and software complexes of APCS; integrated systems of measurement and metering of power consumption; telecommunications systems based on different communication lines; transient

mode monitoring systems WAMS (Wide Area Measurement System); dispersed protection systems and emergency automatics WAPS (Wide Area Protection System).

The choice of technical means plays a decisive role in the implementation of the Smart Grid concept in practice. Optimal transmission of power flows in grids becomes possible with the use of CE devices (power parameter converters), in particular, converters for DC lines and inserts, flexible AC line control devices. Power electronics are indispensable in converters for power storage.

In addition, the widespread spread of dispersed energy requires the creation of a new generation of energy technology:

1. Adaptive power engineering. Built-in sensors and automatic control increase efficiency and expand the dynamic range, allow real-time performance diagnostics, foresee failures, implement unconventional solutions for building a new generation of machinery, in particular compressors and heat pumps.

2. Hybrid energy-consuming installations allow to realize a mode of utilization of losses of the energy-consuming consumer, getting energy in any kind and transforming it into a kind necessary for the consumer, including a mode of the active consumer-regulator.

3. In the implementation of seasonal and daily energy accumulators use peaks (daily and seasonal) with the accumulation of low-potential heat.

4. Energy systems, in which the optimization of energy flows of different types is carried out jointly on the basis of hybrid power installations of the consumer and the complex analysis of systems, previously considered completely independently.

5. Automated self-renewable and self-adjustable power systems, which allow to diagnose systems or their units (generation, networks or consumers), foresee failure, choose (calculate) the most optimal configuration of the working part of the system and carry out switching to a new optimal power supply scheme of the faulty part of the system. High-speed phase-sensitive digital sensors are required for diagnostics, as well as real-time communication facilities.

To determine the feasibility of using the Smart Grid energy-saving management application on the basis of the university energy-innovation Knowledge Hub, the resource savings were calculated before modernization and potential after the implementation of the Smart Grid application according to equation (1). The results of the calculation of the potential effect of the implementation of the Smart Grid application are presented in Table 1.

Fig. 1 shows a projected estimate of the change in the total cost of saved electricity due to the implementation of the project.

Table 1

Results of calculation of the predictive effect of the Smart Grid application

Years	2020	2021	2022	2023	2024
Cost of electricity consumed by KNUTD buildings before modernization					
Pessimistic outlook	4267,37	7773,26	13783,86	24887,86	44782,07
Neutral outlook	4267,37	7387,04	8678,07	14407,87	21662,88
Optimistic outlook	4267,37	6108,83	7130,70	7377,87	8828,07
Cost of electricity consumed by KNUTD buildings after the implementation of the Smart Grid application					
Pessimistic outlook	771,01	1183,71	2118,34	3838,67	7838,00
Neutral outlook	771,01	887,36	1471,77	2221,38	3347,37
Optimistic outlook	771,01	788,08	841,83	1137,36	1370,77
Cost of electricity consumed in KNUTD dormitories before modernization					
Pessimistic outlook	4633,30	8168,84	14787,88	27610,74	47688,77
Neutral outlook	4633,30	7788,86	10188,83	16341,81	22848,83
Optimistic outlook	4633,30	6438,87	7627,86	7866,00	8400,26
Cost of consumed electricity in KNUTD dormitories after the implementation of the Smart Grid application					
Pessimistic outlook	787,77	1428,60	2667,83	4732,76	8374,77
Neutral outlook	787,77	1180,42	1777,27	2780,88	4038,71
Optimistic outlook	787,77	862,33	1137,81	1372,77	1764,26
Value of energy savings					
Pessimistic outlook	7331,88	13211,07	23804,67	42837,28	77877,17
Neutral outlook	7331,88	11008,23	17630,86	24847,38	37117,76
Optimistic outlook	7331,88	8807,38	10678,81	12721,87	16203,38

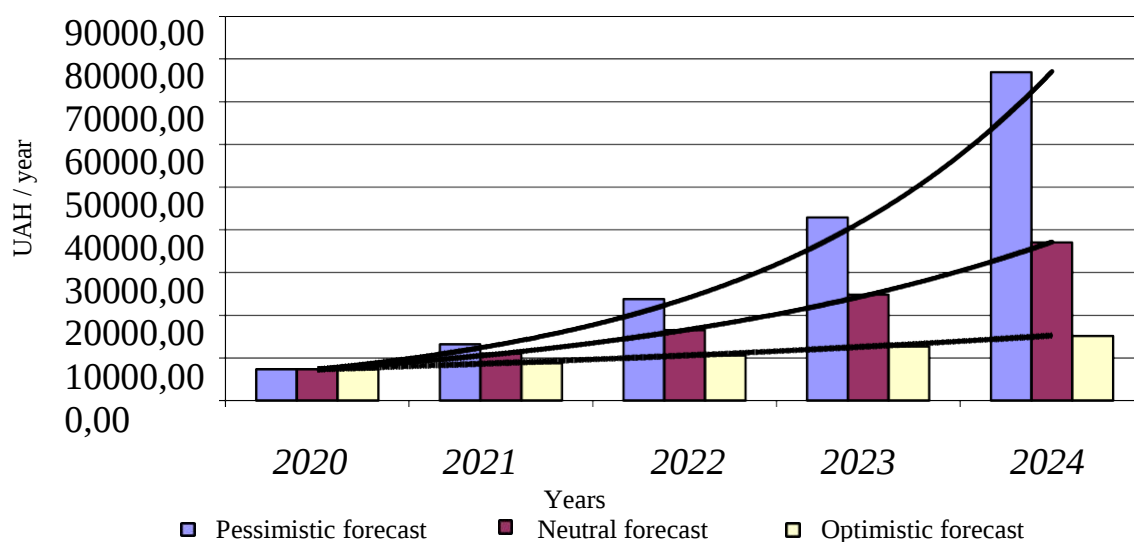


Fig. 1. Forecast estimate of the change in the total cost of energy saved after the implementation of the Smart Grid application

Determination of the relative error of the total heat consumption forecast is shown in Table 2.

Table 2

**Observation data and calculated values of heat consumption levels
by the example of building No. 4 of KNUTD (fragment)**

Period	January 2020	February 2020	March 2020
Actually	1478,77	1869,986	1953,4613
After implementation of the Smart Grid application	1551,123; [1432,78-1669651]	1912,965; [1842,26-1983,67]	1928,577; [1856,66-2000,45]
Period	November 2021	December 2021	January 2021
Actually	2087,159	2003,5019	1593,73
After implementation of the Smart Grid application	1971,63; [1897,06-2046,22]	2077,44; [1993,45-2161,44]	1526,459; [1411,4-1641,52]
Period	February 2021	March 2021	November 2022
Actually	1885,1671	1737,1216	1954,371
After implementation of the Smart Grid application	2096,38; [2010,66-2126,11]	1949,92; [1876,9—2012,9]	1851,908; [1746,37-1918,44]
Period	December 2022	January 2022	February 2022
Actually	1881,341	1533,088	1869,986
After implementation of the Smart Grid application	1933,15; [1861,0-2005,3]	1438,371; [1333,48-1541,94]	1796; [1702,97-1889,28]

As can be seen from the above data, the absence of the aforementioned periods of increased electricity consumption before and after the modernization provide approximately the same prediction accuracy. Due to the implementation of the project of automated control of the lighting system based on the Smart Grid application, the level of cash expenditures was reduced by one third in one year of operation, and the increase in the period of operation will lead to an increase in efficiency, in particular, the projected efficiency of the project is – 46.54%. The reduction in installed capacity as a result of the project was 80.5%, i.e., a 1% reduction in capacity creates an economic effect of 0.58% of the costs associated with the modernization. Taking into account the current level of electricity consumption, we can forecast a potential reduction of expenditures by 951 thousand UAH per year or almost 50% of the cost of electricity consumed in 2020. Given that the share of utility costs in the university's budget was 6.42% in 2018, 7.01% in 2019, and 6.92% in 2020, electricity costs are about 2% of total costs, the amount of electricity consumed savings tends to increase up to 20% annually. On this basis, it is possible to predict an annual decrease in

expenses for electric power and reduction of specific expenses to 1.67% in the budget of the university. The analysis of the actual indicators of electricity consumption based on the data obtained from the implemented in the university software and hardware complex "Automated University Energy Management System" shows that the implementation of the application Smart Grid-management of energy saving on the basis of the university energy-innovative Knowledge Hub confirms the validity of the implemented prediction for the first year of the application.

CONCLUSION.

The Smart Grid concept is seen as a problem-oriented technological platform (as is done, for example, in the EU) to implement an innovation strategy. Smart Grid technologies should ensure the optimal distribution of power flows in the power grid, reducing losses in the grid, quick coordinated response in case of accidents, the ability to combine both large power plants and alternative modern energy sources into a single power system. Smart Grid efficiency means automation of management decision-making, and increased efficiency in managing normal and emergency modes. All this is related to grid companies' efficiency indicators – quality and reliability of power supply while optimizing their own costs. Informatization of grids requires a completely different level of informatization from the primary equipment. Requirements on the number of measurable signals and telecommunication interfaces are significantly expanded; problems of equipment protection from interference, issues of electromagnetic compatibility are aggravated. Formation of energy management system in educational institutions is one of the important elements of budgeting and a prerequisite for effective use of the energy component of costs. An important aspect of the evaluation of measures in the sphere of energy supply and energy costs is the implementation of an analysis of the potential economic effect and investment approach, i.e. the evaluation of the energy component not as a source of costs, but as an investment resource. The harmonization of energy management system with the requirements of ISO 50001:2011 standard and systematic application of the evaluation procedure of the implemented measures opens new perspectives in the development of domestic universities and requires further research.

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ABBREVIATIONS:

%	Percentage
AMOS	Automatic system for measuring current processes
DGMS	Dispersed system of current processes monitoring of generation processes
DMCS	Demand management system, dispersed monitoring and control system
Eq.	Formula of calculation

EU	European Union
FACTS	Flexible AC transmission systems
Fig.	Figures
HEI	Higher education institution
KNUTD	Kyiv National University of Technology and Design
WAMS	Wide Area Measurement System
WAPS	Wide Area Protection System

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ADVANTAGES AND PROSPECTS OF CO-BRANDING IN THE UKRAINIAN MARKET

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BACKGROUND

OBJECTIVES. The marketing practices of companies over the past two decades have increasingly been based on co-marketing, or inter-firm marketing alliances. The mutual recognition and understanding that each firm's success depends in part on the other firm forms the foundation underlying co-marketing activities. Firms move from trying to win alone to forming networks of partner firms. Corporations understand the need for alliances to acquire and maintain competitive advantage.

METHODS. We used general scientific and special research methods: abstract-logical – to summarize theoretical and methodological foundations of co-branding as an integrative marketing tool for joint development of companies; economic-statistical – to analyze the level of development of poultry companies; monographic – to study the experience of individual companies with horizontal form of co-branding; analysis and synthesis – to study the components of co-branding companies; sociological research – to identify key success factors of co-branding.

AND FINDINGS. The structural and logical model of co-branding alliances of poultry companies, the use of which is based on a co-branding strategy, creates the necessary basis for its further development within the framework of modern marketing theory, will increase the effectiveness of co-branding.

CONCLUSION. Co-branding, which is a form of strategic collaboration between two brands that involves bringing them together to create a new product or service, makes the marketing alliances of companies visible to the consumer. In doing so, companies imply recognition of the fact that their prominence represents added value. Closer collaboration with retailers, more focused promotion, and co-branding are becoming ways for many consumer companies to control costs and keep prices down. An example of such cooperation is the use of a co-branding strategy for poultry companies.

KEYWORDS: co-branding; alliance; poultry companies.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
15	1	5

JEL Classification:
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3206.2021.2.9

ПЕРЕВАГИ ТА ПЕРСПЕКТИВИ КО-БРЕНДІНГУ НА РИНКУ УКРАЇНИ

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ПОСТАНОВКА ПРОБЛЕМИ ТА ЗАВДАННЯ. Маркетингова практика компаній у останні два десятиліття дедалі частіше виходить з ко-маркетингу, чи міжфірмових маркетингових альянсах. Взаємне визнання та розуміння того, що успіх кожної фірми частково залежить від іншої фірми, утворює фундамент, що лежить в основі спільної маркетингової діяльності. Від спроб перемогти наодинці фірми переходять до формування мереж партнерських фірм. Корпорації розуміють необхідність альянсу для придбання та підтримки конкурентних переваг.

МЕТОДИ. Використані загальнонаукові та спеціальні методи досліджень: абстрактно-логічний – для узагальнення теоретичних та методичних засад ко-брендингу як інтегративного маркетингового інструменту спільного розвитку компаній; економіко-статистичний – для аналізу рівня розвитку птахівницьких підприємств; монографічний – вивчення досвіду окремих підприємств із горизонтальною формою ко-брендинга; аналізу та синтезу – для вивчення складових ко-брендингу компаній; соціологічного дослідження – для визначення ключових факторів успіху кобрендингу.

РЕЗУЛЬТАТИ. Розроблено структурно-логічну модель ко-брендингових альянсів птахівницьких компаній, використання якої базується на ко-брендинговій стратегії, створює необхідний базис для його подальшого розвитку в рамках сучасної маркетингової теорії, підвищить результативність спільного брендингу.

ВИСНОВКИ. Спільний брендинг, що є формою стратегічного співробітництва двох брендів, що передбачає їх об'єднання для створення нового продукту або послуги, робить маркетингові альянси компаній видимими для споживача. При цьому компанії мають на увазі визнання того факту, що їх популярність є доданою цінністю. Тісна співпраця з роздрібними продавцями, більш сфокусоване просування та ко-брендинг для багатьох компаній споживчого сектора стають способами контролювати витрати та не допускати зростання цін. Прикладом такої співпраці є використання стратегії ко-брендингу для птахівницьких компаній.

КЛЮЧОВІ СЛОВА: ко-брендинг; альянс; птахівницькі компанії.

INTRODUCTION.

Economic development in the new millennium is characterized by rapid and sometimes unpredictable and contradictory changes (Bucklin and Sengupta, 1993), associated with technological transformations, market evolution, rapid change in preferences, tastes and fashion. From the point of view of F. Kotler, F. de Bez, companies face fundamentally new challenges, requiring from them non-standard solutions in the field of promotion of their products on the market (Kotler and de Bez, 2010). As K. Keller, in the conditions of technological progress providing a constant inflow of innovations, "brands must without the slightest hesitation push their boundaries far beyond the initial prototype" (Keller, 1993).

In the era of globalization and increased competition in domestic and foreign markets, domestic enterprises need effective competitive advantages, which is achieved by branding technologies (Park et al., 1996). For corporations in most countries of the world, branding is an important element of their market activities (de Bono, 2005), but the Ukrainian experience of working with brands is not yet rich enough (Nifatova, 2017).

The vast majority of domestic manufacturers do not use branding technologies, especially those worked out in the West in recent years (Nifatova and Dudko, 2020). In the conditions of intensified activity of Ukrainian companies without creating strong brands that would guarantee a high level of consumer preference for domestic goods and services, it is very difficult for their producers in a competitive environment not only to succeed in the domestic market, but also in international markets (Anderson and Narus, 1990).

Scientists predict that in the near future large multinational corporations will prefer to control markets through the ownership of dominant brands, rather than simply enterprises for the production of goods. This trend becomes evident in the conditions of intensified processes of mergers and acquisitions of companies: buyers are willing to pay huge money for the ownership of popular brands among consumers (Cegarra and Michel, 2001).

As a result of the global financial crisis a significant change in the position of many strong consumer brands on the global market is predicted. Under these conditions it is very important for Ukraine not to miss the chance to promote its national brands (Nifatova, 2017). Strong national commercial brands known to foreign consumers would allow Ukraine to form a positive image of the country, increase its attractiveness and improve its investment climate (Nifatova and Dudko, 2020).

Marketing tools can and should be used to enhance innovation and integration processes in the economy. One of the relevant and convenient forms of transformation for medium and large businesses is a partnership based on co-branding (Carter, 2002). Co-branding can act as a powerful "driver" of modern

innovative and integration projects simultaneously. The advantages of using this marketing tool can be: improvement of companies' management, increase of communication potential, reduction of costs of market information, as well as exchange of experience between partner companies. Thus, the competently formed system of organization of innovation and integration processes on the basis of co-branding is able to provide competitiveness and successful development of domestic enterprises in the long term.

The purpose of the study is a comparative analysis of the advantages and prospects of co-branding in the market of Ukraine. The study was conducted in 2020 on the basis of the study of brands of poultry industry enterprises in Ukraine.

RESULTS AND DISCUSSION.

Some researchers call co-branding a brand alliance. It involves a short- or long-term association or combination of two or more individual brands, products and/or other company assets, in which products can be presented "physically" (combining several products in one "package") or "symbolically" (joint product advertising). In other words, co-branding is a form of cooperation between two or more brands, sufficiently known to the consumer, in which the names of all brands are preserved. The proposed classification is based on three forms: advertising sponsorship, value chains, and innovative co-branding alliances (Table 1).

Table 1

Definitions of co-branding

Authors	Definition
C. Hillyer and S. Tikoo (1995)	The practice of "double branding", which allows you to demonstrate ownership of a product by more than one brand
L. Leuthesser, C. Kohli, R. Suri (2002)	Combining two or more recognized brands into a single whole
P. Kumar (2005)	Two or more brands (component brands) combined to produce one unique product (composite brand)
C. Hadjicharalambous (2006)	Use of two or more brands in the name of a new product, service or business
O. Wright and L. Frazer (2005)	Synergistic association of two or more brands in one business, product or promotion action

The type of co-branding implies fixing its typical situations: merger of companies or creation of a joint venture. The level of co-branding indicates the structural unit within which the interaction is carried out - separate divisions of the company or the firm as a whole. Co-branding, respectively, is divided into: coalition, coordination, collaboration and cooperation (Wright and Frazer, 2005). F. Kotler, F. de Bez indicate the existence of co-branding joint ventures (Kotler and de Bez, 2010). Table 2 summarizes the main types of co-branding.

Table 2

Types of co-branding

Types	Contents
Ingredient co-branding	The brand ingredient is part of a product promoted under another brand
Co-branding to achieve awareness	Rapid growth of knowledge about the company's brand through contact with the partner's customer base
Co-branding to achieve value	Improved consumer perception of the firms product within the framework of the association
Co-component co-branding	Introduction of one company's product as a component of another company's product.
Co-branding based on complementary competencies	Combining the abilities and expertise of companies, including in the intangible sphere
Promotional sponsorship	Building associations with an event or activity with one or more brands
Co-branding in value chains	Associations of manufacturers of similar goods; alliances of manufacturers and retailers
Innovative co-branding alliances	Creation of completely new products or services
In-branding	Promotion by a company of a product which is a component of a complete solution offered by another company
Functional alliance of brands (alliance of constituents)	Creation of a new product out of components offered by different brands
Symbolic alliance	Co-promotion of partners' own products by combining their sales and marketing communications efforts
Coalition	Two companies merge to form a single firm with a double name
Coordination	Two companies merge their two units into a single firm by giving it a double name
Collaboration	The two companies establish a joint venture, sharing resources, informal knowledge and know-how
Cooperation	Two companies work in a joint venture created from their units.
Co-branding joint company	Two companies jointly finance the creation of a co-branded product (often combining products from the same category)

The unprecedented growth of co-branding activity in recent years has prompted the idea that "strategic partnerships are a serious brand building tool. The benefits of co-branding are systematized in Table 3.

Possible obstacles to the implementation of co-branding are summarized in Table 4.

In the context of the concepts of co-branding considered by us, a co-brand would be a set of expectations and associations arising as a result of the unification in the minds of target consumers of the images of jointly operating companies, formed on the basis of contacts with their goods, communication messages and other points of interaction. Active use of co-branding by

companies leads to the fact that co-brands are gradually taking their full place in the continuum of existing brand forms in marketing practice.

Table 3

Benefits of co-branding

Authors	Benefits
C. Hillyer and S. Tikoo (1995)	Increased sales and revenues in markets where the brand is already present and in new markets Opportunity to sell at a price above face value, due to greater added value Consumers receive products with additional features, functions and applications
L. Leuthesser, C. Kohli, R. Suri (2002)	Ability to enter new markets at a relatively low cost Gain synergies due to technological specialization in different areas Joint marketing efforts can lead to an expansion of geographic and media presence
P. Kumar (2005)	New source of funding, as costs will be shared among partners More visible image and credibility of products and brands Improved consumer perception of the brand and product
C. Hadjicharalambous (2006)	Risk allocation in adverse conditions Growth of brand awareness and recognition Transfer of positive associations about the original brands to the new co-brand
O. Wright and L. Frazer (2005)	Ability to reach markets more easily and quickly due to association with a partner brand Smaller brands can achieve advantages along with well-known brands by connecting with their markets, positive associations, credibility, image and reputation

Table 4

Disadvantages of co-branding

Authors	Disadvantages
C. Hillyer and S. Tikoo (1995)	Difficulty for one of the parties to abandon the partnership and create their own market Transfer of competitive advantages to the partner, creation of a potential competitor
L. Leuthesser, C. Kohli, R. Suri (2002)	Incompatibility of co-branding partners due to different business cultures
P. Kumar (2005)	Negative impact of one of the brands on the overall product Unbalanced benefits for partners from participation in co-branding
C. Hadjicharalambous (2006)	Probability of one brand's market shrinking as opposed to the original plans "Blurring" of one brand in the shadow of another
O. Wright and L. Frazer (2005)	The possibility of one party behaving to the detriment of the other Risk associated with the exchange of information and know-how between partners

When combining their marketing efforts, cooperating companies must choose a specific form of co-branding. However, while co-branding has become very fashionable, not all alliances are worth flaunting. Thus, the question of the extent to which marketing alliance partners should "publicize" their collaborative efforts is not trivial or unambiguous, which has given rise to a continuum of co-branding architectures, or forms of relationship between the brands, companies and their products and services being brought together (Figure 1).

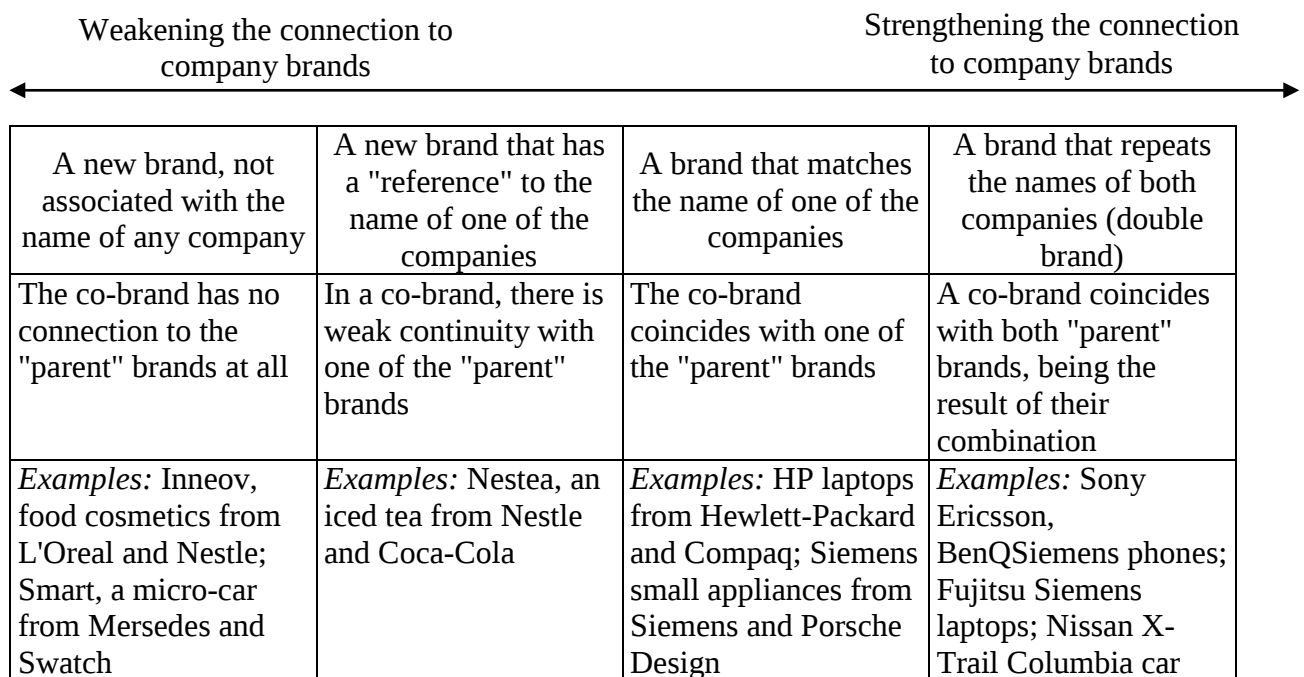


Figure 1. Co-branding architectures

The bipolar structure of the continuum suggests that in choosing a particular form of co-brand, companies can either veil or emphasize the fact that the product is the result of their joint efforts. As we can see, co-brands do not always carry the features of their parent brands.

Theoretical generalizations concerning the essence of branding, co-branding and brand management and their empirical confirmation, based on the experience of using branding to promote products by agricultural companies of the poultry industry, allowed to propose the author's algorithm of design, implementation and development of the poultry brand. co-branding.

A set of strategies for poultry companies, referred to such type of companies as nicheurs, is formed. These companies specialize in serving one or more segments of the market, left unattended by other market participants. The directions of realization of strategies are proved. A methodical approach to the development of new poultry meat brands by agricultural companies for their

joint promotion through the franchise network of the producer-leader of the poultry industry on the co-branding basis is proposed. Proposals to determine the impact of branding on increasing consumer loyalty (approval and preference for certain products, brand attributes, marketing activities, point-of-sale service, etc.) to the brands of poultry companies have been developed.

On the example of the company "Podolsky Broiler", an insignificant by market share and competitive position of the poultry company, a set of strategies for different stages of brand formation was formed (Table 5).

Table 5

Set of strategies of poultry company and franchisee of TM-producer-leader at different stages of their brand formation

Type of strategies	Strategies selected for two co-branding participants
According to the BCG matrix	For the leader – a strategy to maintain competitive advantage in order to maintain their market share; for Nisher – a strategy of development, intensification of efforts to increase their market share.
According to the matrix of M. Porter	For the leader – a strategy of differentiation; for Nisher – a strategy of concentrated marketing.
Behind the McKinsey matrix	For the leader – a strategy to protect positions; for Nisher – a strategy of selective development.
Global marketing strategies	For the leader – a strategy of internationalization, globalization and diversification; for Nisher – the strategy of cooperation.
Basic marketing strategies	For the leader – the strategy of price leadership and product (brand) and service differentiation; for the niche – the strategy of focusing (concentration) on product (brand) and image differentiation.
Marketing growth strategies	For the leader – strategies of intensive and integrative growth and strategy of diversification; for Nisher – a strategy of intensive growth and a strategy of integrative growth.
Competitive marketing strategies	For the leader – the strategy of the market leader, namely the strategy of protecting their positions, increasing the share of the available market capacity, expanding market capacity; for an outsider – a niche strategy, namely – strategies for maintaining positions in this niche, integrating efforts with another partner, going beyond the niche; follower's strategy in terms of compiling and simulating the components of the leader's marketing complex.
Functional marketing strategies	For the leader – co-branding strategy; for Nisher – branding strategy.

At the initial stage of this process it is reasonable for the company to stick to the strategy of supporting the position in the niche, left without attention of other market participants and realization of which is possible at the expense of search of ways to provide competitive advantages, investing into segments with high profitability and low level of risk. Specialization of the company concerning the niche is formed according to two criteria: qualitative properties of the products and one of the elements of the marketing complex – the system

of constant sales promotion. At the second stage of branding it is reasonable to use such a niche strategy as integration strategy (or cooperation strategy as a kind of global strategy) – joining forces with another manufacturer (another brand) for mutually beneficial cooperation, including through the joint creation of a new brand.

Vertically integrated agro-industrial holding "Mironovsky Product" was chosen as a partner of "Podolsky Broiler" on cooperation and integration efforts, which is offered the strategy of integrative growth – joining efforts with competitor companies in the regional market. The essence of cooperation, integration and integrative growth strategies is to create a strategic marketing alliance between the two companies on a co-branding basis (lateral co-branding of Podolsky Broiler with a regional franchisee of TM Nasha Ryaba). Participants of this alliance, in addition to suppliers, producers, intermediaries, competitors-partners, should be loyal to its products consumers who have formed a desire to be involved in the process of brand formation, involved in the dissemination of brands in the market.

CONCLUSION.

Theoretically proved that co-branding of poultry industry companies based on its binary nature should be considered as a way to implement individual perceptions and expectations of the target audience into specific differential brand characteristics, which create added value and are transformed for consumers into steel values, and for brand owners provide capitalization of the brand.

Management of co-branding of poultry companies should be carried out with the help of the developed structural and logical model, which is based on the use of brand attributes for stage-by-stage involvement of consumers in this process, formation of image vision of brands, perception and acceptance by target audience, and also evaluates the effectiveness of appropriate marketing activities, predicts the time horizon of co-branding. The implementation of such a model involves the following steps: 1) action of existing laws, principles of construction and promotion of brands, development and use by companies of attributes of brands of different levels create in consciousness of consumers nine rows of images of these brands; 2) created images form eight levels of attraction of consumers to the brand; 3) established in consciousness of consumers levels of attraction are transformed in four levels of perception of the mentioned brands by consumers

The feasibility of implementing this method is based on a combination of such parts as: 1) new technologies of poultry production; 2) development of all components of the future brand using marketing research methods; 3) effective use of marketing complex components (4P) as the basis of positioning and key factors of brand success; use of the latest creative technologies on the process of

branding (branding) of poultry products; 5) application of effective brand management in maintaining brand viability in the market.

ABBREVIATIONS:

%	Percentage
Eq.	Formula of calculation
Fig.	Figures

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ORGANISATIONAL APPROACHES TO THE FORMATION OF SOCIAL RESPONSIBILITY OF HIGHER EDUCATION INSTITUTIONS IN THE MARKET OF EDUCATIONAL SERVICES

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BACKGROUND AND OBJECTIVES.

Social responsibility is a system of innovative working relationships that acts as an essential technology that enhances the effectiveness of a higher education institution with employees, partners, customers and the community, and ultimately contributes to its prosperity and civil society. Social responsibility should focus on enhancing the image of the higher education institution, recognising its successes in society by civil institutions and individual citizens. This will increase the social value of the higher education institution, its competitiveness, sustainability and efficiency, allowing society to use the resource voluntarily provided by the higher education institution to balance organisational and social interests.

METHODS. The methods used to conduct the research were: interview, expert. The questions selected for this study were taken either from the literature or from individual interviews. The literature helped to identify important dimensions of the concept of social responsibility. The interviews helped to identify new points and possible dimensions to contextualise organisational approaches to shaping the social responsibility of higher education institutions.

FINDINGS. Organizational approaches to the formation of social responsibility of higher education institutions in the market of educational services are proposed. Mechanisms to increase socio-commercial value of socially responsible higher education institutions are argued: creation of public institutions to identify, formulate public interests and present them to corporations; selection of social projects taking into account stakeholder expectations.

CONCLUSION. In order to increase the efficiency of using the principles of social responsibility in HEIs, to improve their ratings, students' competitiveness in the labour market and their involvement in the task-setting and decision-making process, it is necessary to develop a programme of corporate social activity, which can become the basis for developing the HEIs' development strategy. The formation and adoption of such a strategy should be based on the interests of all stakeholders, based on the core values of the university to achieve the indicators at micro-, meso- and macrolevels.

KEYWORDS: social responsibility; stakeholders; higher education institution.

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ОРГАНІЗАЦІЙНІ ПІДХОДИ ЩОДО ФОРМУВАННЯ СОЦІАЛЬНОЇ ВІДПОВІДАЛЬНОСТІ ЗАКЛАДІВ ВИЩОЇ ОСВІТИ НА РИНКУ ОСВІТНІХ ПОСЛУГ

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ПОСТАНОВКА ПРОБЛЕМИ ТА РЕЗУЛЬТАТИ.

ЗАВДАННЯ. Соціальна відповідальність – це система інноваційних трудових відносин, що виступає як найважливіша технологія, що підвищує ефективність роботи вищого навчального закладу зі співробітниками, партнерами, клієнтами та населенням, і сприяє, зрештою, його процвітанню та громадянському суспільству. Соціальна відповідальність має бути спрямована на підвищення іміджу вищого навчального закладу, визнання його успіхів у суспільстві з боку громадських інститутів та окремих громадян. Це підвищить соціальну цінність вищого навчального закладу, його конкурентоспроможність, стійкість та ефективність, дозволить суспільству використати ресурс, добровільно представлений вищим навчальним закладом, для забезпечення балансу організаційних та соціальних інтересів.

МЕТОДИ. Для проведення досліджень було використано методи: інтерв'ю, експертний. Питання, відібрані для цього дослідження, були взяті або з літератури, або з індивідуальних інтерв'ю. Література допомогла визначити важливі виміри концепції соціальної відповідальності. Інтерв'ю допомогли визначити нові пункти та можливі виміри, щоб контекстуалізувати організаційні підходи щодо формування соціальної відповідальності закладів вищої освіти.

Запропоновано організаційні підходи щодо формування соціальної відповідальності закладів вищої освіти на ринку освітніх послуг. Аргументовано механізми підвищення соціокомерційної цінності соціально відповідальних вищих навчальних закладів: створення громадських інститутів, що дозволяють виявляти, формулювати суспільні інтереси та пред'являти їх корпораціям; відбір соціальних проектів з урахуванням очікувань стейкхолдерів.

ВИСНОВКИ. З метою підвищення ефективності використання принципів соціальної відповідальності у вузах, підвищення їх рейтингів, конкурентоспроможності студентів на ринку праці та залучення їх до процесу постановки завдання та прийняття рішень необхідно розробити програму корпоративної соціальної діяльності, яка може стати базою для розробки стратегії розвитку вузу. Формування та прийняття такої стратегії має будуватися з урахуванням інтересів усіх зацікавлених осіб, виходячи з основних цінностей університету для досягнення показників на мікро-, мезо- та макрорівнях.

КЛЮЧОВІ СЛОВА: соціальна відповідальність; стейкхолдери; вищий навчальний заклад.

INTRODUCTION.

The idea that an organisation has a responsibility to society has been around for a long time. However, the concept of social responsibility is evolving: not least in terms of to whom and what responsibility should be to (Closon and Leys, 2012). From the outset it is important to understand what social responsibility is. In fact, the concept of social responsibility has been increasingly used in the economic sphere for decades. Until now, however, the concept has been hampered by the lack of a definition with which all actors in the world can agree (Acquier and Grond, 2005). The term itself creates problems of understanding and interpretation. Responsibility in the philosophical sense is to be considerate of others. Furthermore, the term 'social' covers both human rights, labour relations and working conditions, environmental protection, consumer protection, community involvement and the management of organisations, as well as ethical issues of business practice (Battaglia et al., 2014).

Today, the definition of social responsibility is leaving the field of theoretical confrontation. Despite the existence of several definitions, scientists agree on the existence of two main perspectives: the social effectiveness model (E. Balemba, T. Bugandwa, B.M. Akonkwa and N. Mutabazi (2019) – how to be responsible) and stakeholder theory (D. Bugandwa, E. Balemba and M. Bakomeza (2014) – to whom to be responsible). It is these theories that underlie corporate social responsibility (Emese, 2020).

Social performance can be understood using Carroll's (1979) three-dimensional conceptual model. The first dimension is based on the organisation being profitable, legitimate, fair and philanthropic. The second dimension refers to the societal areas in which responsibility should be applied. Finally, the third and final dimension of Carroll's model concerns the philosophy of giving answers. These can be rejection (no change), challenge (responds only to what is stated in the law), acclimatisation (slow but gradual integration) and expectation (forward-looking position).

Stakeholder theory asks which groups deserve or have the right to demand management attention and which do not (Granget, 2005). A company needs to define stakeholders as people or groups of people who have a legitimate interest in the company (Kennedy et al., 2002). Corporate social responsibility is not and should not be separated from the company's strategy and activities: it is about integrating social and environmental issues into the company's strategy and activities, and its important aspect is how companies interact with all stakeholders (Shcherbak et al., 2019).

In such a tough competition universities should implement the principles of social responsibility, which is vital in the competition. Moreover, the actions of universities are directly oriented towards society: their mission is not only to

promote knowledge and research, but also to develop society. UNESCO even stresses that the development and well-being of nations is closely linked to the quality of higher education institutions. As a result, social responsibility becomes one of the main pillars of the entire university's mission and vision. It is inseparable from the mission of universities (Rizkallah, 2017). This explains the importance that universities should attach to corporate social responsibility.

The purpose of the study was to substantiate organisational approaches to the formation of social responsibility of higher education institutions in the market of educational services. The study was conducted in 2021 based on data from Kyiv National University of Technologies and Design (KNUTD).

MATERIALS AND METHODS.

The methods used to conduct the research were: interview, expert. The questions selected for this study were taken either from the literature or from individual interviews. The literature helped to identify important dimensions of the concept of social responsibility. The interviews helped to identify new items and possible dimensions to contextualise organisational approaches to social responsibility formation of higher education institutions. To this end, qualitative interviews were conducted with 80 KNUTD students and 30 teachers.

RESULTS AND DISCUSSION.

The concept of social responsibility first emerged in the commercial sector and was later extended to non-profit enterprises. There are two reasons for extending social responsibility to higher education. The first is the growing trend of commercialisation of higher education. The growing involvement of private companies in the education sector and the importance of human capital in production means that universities are developing marketing factors in order to remain competitive. The second reason is that all companies are encouraged to implement a social responsibility strategy and staff are trained by universities. Universities then incorporate social responsibility into their strategy and even into their curricula. It is believed that companies should commit themselves to encouraging universities to develop their curricula to train quality staff.

An educational institution that implements the principle of a socially responsible institution has, in our view, the following functions:

1) reproduction of public intelligence – provision of educational services to society aimed directly at serving the individual and free development of the individual;

2) preparation of highly qualified personnel (society elite) – one of the decisive factors in the development of the education system as a whole, as well as ensuring scientific and technological and socio-economic progress of the country;

3) formation of the labor market – new knowledge created in an educational institution has a direct impact on the labor market, forcing to

reassess the importance of certain skills, changing the quantitative and qualitative requirements for labor resources;

4) development of culture and norms of behaviour, the existence and observance of which largely determines the psychological climate in higher education institution and its market capitalisation;

5) stabilisation of social relations – an educational institution acts as an active participant in social interactions with stakeholders and many representatives of the regional social environment.

The main partners for universities, as the researchers point out, are regional governments, businesses and the business community. This tandem demonstrates a coherent partnership to address other important objectives: improving the quality of education, meeting labour market needs, and meeting the research and development needs of businesses to develop a particular economic sector or cluster (Figure 1).

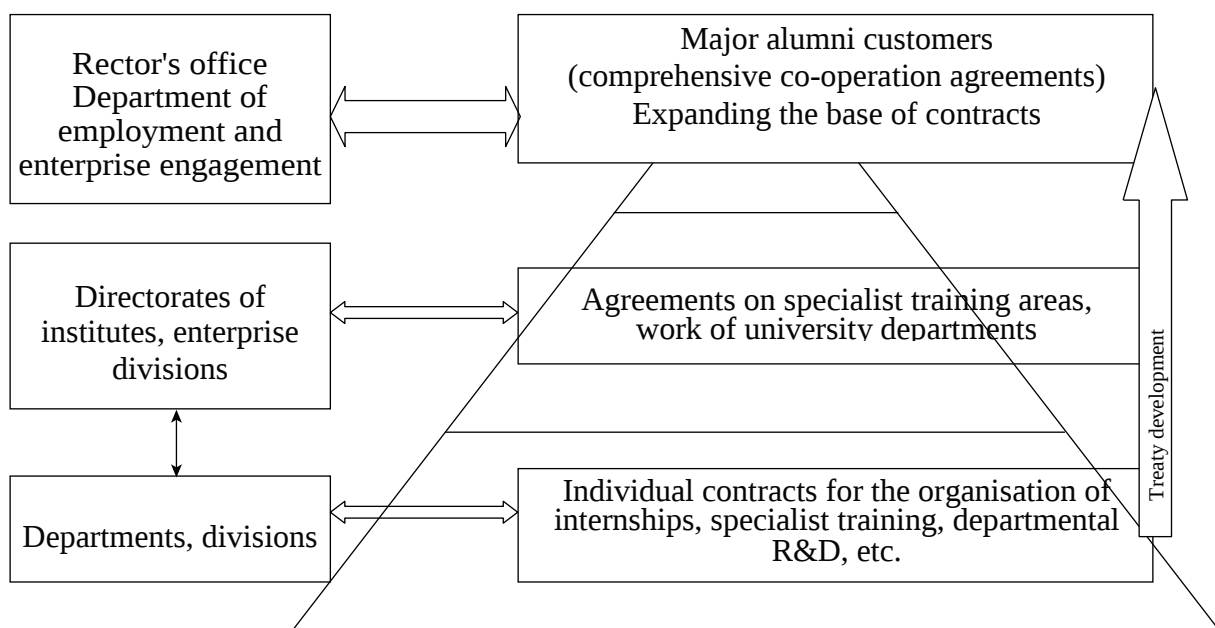


Figure. 1. Structure of the university's relationship with companies

Many scholars argue that universities as a special type of organisation should adopt a social responsibility strategy in the same way as other organisations in order to meet the expectations of stakeholders. E. Balemba, T. Bugandwa, B.M. Akonkwa and N. Mutabazi (2019) put it this way: "Universities do not have a customer base in the commercial sense that they must attract as companies. However, commitment to a social responsibility approach is well promoted, especially to attract new students, in a competitive environment between institutions. It also undoubtedly helps to attract and retain staff, whether professors or administrative staff".

Assessment of employers' satisfaction with the quality of graduates' training is carried out in a comprehensive way, including:

- Direct communication with the representatives of companies at the ongoing events on employment of graduates. At the same time the issues of university's interaction with production representatives and maintaining feedback (work planning for the year, companies' feedback on students' internships, quality of specialists training) are discussed in order to improve practical training of future young specialists, use dual training and adaptation to the conditions of real production of bachelors and masters.

- Annual events (master classes, methodological seminars, round tables, conferences), including in cooperation with companies, institutions and organisations.

- Expert surveys in the form of questionnaires. To assess the level of training of university specialists, expert surveys are organised for the heads of companies or divisions where graduates work.

CONCLUSION.

Integrating the considered scientific-theoretical and practical approaches in the aspect of problems, it is logical to conclude that the category "social responsibility" determines the essence and meaning of the concept "social responsibility of HEIs". Hence, it is possible to propose the principles of social responsibility of higher education institution in solving the problems of training quality and employment of graduates:

- unconditional observance of legislation, international agreements, generally accepted ethical norms of educational and social activities;

- contributing to the economic development of the region and state by training highly-qualified specialists;

- provision of educational services to ensure the competitiveness of graduates in the labour market;

- continuous improvement of the quality of corporate governance and greater transparency of educational programmes;

- conducting a systematic dialogue with stakeholders (employers) and making decisions related to educational activities based on a reasonable balance of the parties' interests;

- improvement of professional qualification and personal level of participants of the educational process (teaching staff);

- formation of social protection measures for graduates by facilitating their employment;

- contributing to the social development of the regions through the implementation of research projects and design solutions.

The aspect considered in the paper is an important, but not the only element of the system of social responsibility of a modern higher education institution.

Universities are not institutions that exist outside the social system. They are interacting elements localised in space. More precisely, universities are embedded in different types of communities, some of which are local, some of which are global. From this perspective, universities are an integral part of the local, national and global social systems that form part of what is commonly called society.

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ABBREVIATIONS:

HEI Institutions of higher education
SR Social responsibility

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