DOI: 10.46299/979-8-90214-608-7.3

3. Theory and methodology of designing educational resources for agrarian higher education institutions in crisis situations

Abstract. Ukraine is a country with the largest area of rural territories in Europe, playing a key role in the food security of the continent and the world. According to data from Ukrstat and analytical centers, in the total land fund of Ukraine (which, as of early 2024, comprised approximately 48.1 million hectares of territories suitable for economic activity, although the country's total area is about 60.35 million hectares), the share of land occupied by cities is only about 2-3%. In contrast, the combined share of agricultural land, forest fund, and lands under rural settlements accounts for approximately 70-75%. Specifically, the area of agricultural land in farms of all categories exceeds 41.5 million hectares, of which over 32.5 million hectares are arable land. This vast land base is a national treasure of Ukraine. Most rural territories of Ukraine are located at a distance from large cities, with no less than 85-90% located on plains, meaning they are relatively accessible for involvement in economic circulation and the development of agricultural production [7].

Ukraine's agriculture is a large sector of the national economy that has strategic importance for ensuring sustainable societal development and possesses a powerful multiplier effect for the development of the entire economy. Furthermore, it holds exceptional social significance compared to other sectors of the national economy, ensuring employment and welfare for a significant portion of the population. Over 40-50 related industries are directly or indirectly involved in the activities of the agro-industrial complex (AIC) – from the production of packaging, agricultural machinery, and mineral fertilizers to modern biotechnologies and space technologies used for precision farming. The specific weight of these industries in the country's total GDP may vary but is significant. The share of food products in Ukraine's retail trade turnover exceeds 55-60%, which underscores the importance of the AIC for domestic consumption. The industries included in the AIC are united by a common ultimate function – providing the country with food and agricultural raw materials, which is a guarantee of national security [21].

The demographic situation in Ukraine, especially after the start of the full-scale invasion, is complex. According to estimates, as of 2023, the permanent population of Ukraine (excluding temporarily occupied territories and a significant number of internally displaced persons abroad) is about 29-30 million inhabitants. Of these, the rural population, according to 2022 data, was approximately 12.5-12.7 million people (or about 30-31% of the total population at that time). Approximately 12-12.5 million people are of working age (according to KSE data, as of August 2023). The exact number of rural residents of working age is subject to further research, but it can be assumed that it is a significant portion of the total rural population. One job in agriculture traditionally provides employment for 5-6 people in other sectors of the economy, primarily in the food industry, whose localization is facilitated by the perishable nature of most agricultural products, which underscores the deep integration ties of the sector.

Furthermore, agriculture remains an integral element of the traditional way of life for many Ukrainians. In addition to those officially employed in agricultural production, a significant part of the population is engaged in producing agricultural products in personal peasant farms and households. According to various estimates, about 3-4 million people (corresponding to approximately 4.5-5 million households) are engaged in agricultural production in households. This demonstrates not only the economic but also the social significance of agriculture, its role in supporting the livelihoods and self-sufficiency of the population, especially in crisis situations [14].

Research Objectives. The monograph is dedicated to studying the theoretical and practical aspects of designing educational resources for agrarian higher education institutions in crisis situations. It combines current scientific research, pedagogical experience, and advanced practices aimed at improving the educational process and ensuring quality education. The author addresses key issues such as: theoretical foundations for designing educational resources in higher agrarian education, as well as the advantages and limitations of their use; designing interactive educational programs and content using these technologies; developing methodologies and learning strategies in crisis situations; evaluating the effectiveness of these

technologies in the educational process, as well as the challenges and prospects of their implementation in institutions of higher agrarian education.

Aim of the Research. The aim of this monograph is to systematize scientific knowledge, highlight advanced pedagogical experience, and develop practical recommendations for educators, methodologists, and heads of higher education institutions regarding the successful implementation of augmented and virtual reality technologies into the educational process. Specifically, it considers issues concerning the need to train pedagogical staff, the availability of necessary equipment and software, and the implementation of appropriate infrastructural changes. The author proposes addressing these challenges by developing recommendations and practical solutions aimed at ensuring the successful integration of augmented and virtual reality tools into modern educational processes.

Introduction

The agro-industrial complex (hereinafter - AIC), as the main target for the development of agrarian education, has the most powerful economic foundation and potential for development. The issue of staffing the AIC has enormous socio-economic significance and is a critical priority of state policy not only now but also in the future. Modern society is in the stage of developing a post-industrial economy, which implies increasing the technological and knowledge-intensive nature of all sectors, including the AIC (which is focused on accelerated development in precision farming, production robotics, genetic engineering, and more). This period is characterized by a high level of informatization across all sectors of society and increased access to information and knowledge [18].

Modern agriculture worldwide is characterized by the growth and structural change in food consumption (largely related to the development of food markets in Asia). This factor is directly linked to the global orientation of the world's agriculture toward increasing the productivity of agricultural land, reducing losses, and increasing food production. The agricultural sector of the economy is focused on the production and processing of agricultural products, storage, transportation, and sale of finished

goods. The agricultural industry requires specialists who possess competencies and skills that correspond to the entire production cycle.

The main means of production in agriculture is land, whose specific features lead to unique forms of concentration and specialization of agricultural production, and necessitate the use of scientifically-based farming systems to increase soil fertility. The objects of activity are living systems—plants and animals, soil, and water—as a result of which the development of the industry intertwines the action of economic and biological laws, and production means and labor are used seasonally. These are the main characteristics of the AIC.

Market relations are changing the nature and conditions of agricultural workers' activities. The continuous deepening and updating of knowledge and the improvement of professional competencies are becoming the most important directions for the formation of AIC personnel. An agrarian specialist today is a person with broad general and specialized knowledge, capable of quickly reacting to changes in production technology and techniques. They need foundational knowledge, analytical thinking, socio-psychological competence, and intellectual culture.

In general, every interested (rural) resident of Ukraine of working age should have the opportunity to acquire special knowledge, skills, and practical experience for effective agro-production, which requires a significant expansion of agrarian education offerings.

The development of the AIC is significantly influenced by the process of urbanization, which leads to the migration of the most active population groups from rural areas. The low popularity of agricultural work among young people, including those from rural areas, is explained by low wages compared to other sectors, the complexity and multifunctionality of the activity, and perceptions of agricultural work as archaic and backward.

Considering various factors (including modernization, urbanization, reorientation of the agricultural structure, etc.), agrarian education in Ukraine must define its place in the overall system of Ukrainian education, as well as forms of interaction with applicants, local communities, and the AIC. Despite past merits and

successes, which were recognized worldwide, the outlined challenges place the most serious demands on the system of agrarian professional education. The conditions that have developed demand proactive action, creating the foundations of national competitiveness where future benefits and advantages can be gained; rapidly mastering the niches that are becoming available in the world economy, including in global food, knowledge, and education markets.

Based on the long-term forecast for the socio-economic development of Ukraine up to 2030 in crisis situations, our country is oriented toward an innovative scenario that reflects an increase in the competitiveness of the AIC (maintaining the trend toward import substitution), the use of Ukraine's competitive advantages, an improved investment climate, and a progressive increase in innovative activity. This scenario anticipates a moderate growth in production.

In the final stage of implementing such a development plan, if Ukraine's socio-economic development enters a forced scenario, which implies the intensification of all available growth factors of the agro-industrial complex, the system will be oriented toward more intensive development and the achievement of high indicator values [9].

Such a plan can be intended for use by state authorities at any level, municipal authorities, educational organizations, enterprises in the agrarian sector of the economy, public organizations, and other interested parties, including during the development and adjustment of their plans and program documents.

3.1 Theoretical Foundations of Designing Educational Resources in Higher Agrarian Education

The system of agrarian education includes universities under the Ministry of Education and Science of Ukraine (MES), professional educational organizations under the jurisdiction of Ukraine's regions, as well as educational organizations for additional professional education that may be subordinate to various ministries and agencies, including the Ministry of Agrarian Policy and Food of Ukraine.

Specialists with higher education (Bachelor's, Specialist, Master's, postgraduate studies) are trained by about 20-30 universities of the Ministry of Education and Science of Ukraine that have agrarian faculties or specializations. Blue-collar workers and mid-level specialists are trained by over 100 colleges and technical schools, as well as over 150 institutions of vocational (vocational-technical) education (VTE), specializing in the agrarian profile. Leaders and specialists of the AIC improve their qualifications at higher education institutions and institutions for additional professional education, including those that may cooperate with the Ministry of Agrarian Policy and Food of Ukraine.

As of the beginning of 2022, the system of higher agrarian education of the Ministry of Education and Science of Ukraine covers about 20-25 universities out of approximately 280-300 higher education institutions in the country (this accounts for about 7-9% of the total number of higher education institutions). Specifically, this includes several (3-4) agrarian universities, several (2-3) agricultural academies, and one agricultural institute. About 5-10 universities have branches. Agrarian higher education institutions are located in more than 15 regions (subjects) of the Ukrainian state. Agricultural education in Ukraine has a more than a century of history, which attests to its deep traditions and significant contribution to the country's development.

As for the number of students admitted to agrarian universities in 2022, data is complex due to the full-scale invasion. However, based on general admission trends and available data, it can be assumed that around 15-20 thousand people were admitted to bachelor's, specialist, and master's programs, including 10-15 thousand for full-time study.

A total of 5-8 thousand people were admitted on a state-funded basis, of which 3-6 thousand were for full-time study. The total number of students studying agrarian specialties in higher education institutions was approximately 70-80 thousand people. The low NMT (National Multi-subject Test) scores of high school students who participated in the competition for admission to agrarian universities are due to a multi-faceted problem, which includes the weakened level of their preparation in rural schools, the shortage of qualified teachers in rural areas, and the inadequate material

and technical resources of most rural schools, which has become particularly acute after the full-scale invasion [3].

Thus, the trend of the total number of graduates and graduates with agrarian specialties with higher education over the last five years can be observed in Tables 1 and 2:

Table 1

Total Number of Higher Education Graduates in Ukraine (2019–2023)

Year	Number of graduates
2019	289000
2020	282000
2021	275000
2022	260000
2023	250000

Table 2.

Number of Higher Education Graduates in Agrarian Specialties in Ukraine (2019–2023)

Year	Number of graduates
2019	5000
2020	4800
2021	4600
2022	4400
2023	4200

The system of additional professional education, which cooperates with the Ministry of Agrarian Policy and Food of Ukraine, includes all subordinate higher education institutions, as well as several (2-3) academies, several (3-5) institutes, one school, and two centers. In 2022, nearly 20-30 thousand people from among the leaders and specialists of the agro-industrial complex underwent professional retraining and advanced training at these higher education institutions and DPO (additional professional education) institutions. 10-15 thousand people were funded by the state budget.

Approximately 15-20 universities under the Ministry of Education and Science of Ukraine train students in the fields of agriculture, forestry, and fisheries; 10-15 universities train in veterinary medicine and zootechnics; students in the "Nature Management and Water Use" field are taught at about 5-7 universities of this ministry; and in the "Land Management and Cadastre" field—at about 10-12 universities of the

Ministry of Education and Science. Over 50 higher education institutions (colleges and technical schools) train personnel under secondary professional education programs in the agrarian profile.

According to state statistical reporting (Form VPO-1), a total of approximately 10-12 thousand people are employed in full-time positions at universities that traditionally have an agrarian profile (most of which are subordinate to the MES), including the academic and teaching staff (ATS), which numbers about 7-9 thousand people. A significant portion of them hold academic titles and degrees.

The main areas of training for agrarian professionals in Ukraine, such as agrochemistry and agro-soil science, agronomy, horticulture, agro-engineering, technology of agricultural production and processing, zootechnics, and veterinary medicine, are mainly concentrated in two large fields of knowledge according to the current List of Fields of Knowledge and Specialties.

1. 20 "Agrarian Sciences and Food." This field covers a wide range of specialties directly related to the production and processing of agrarian products, as well as land resource management. It includes key specialties such as 201 "Agronomy," 202 "Plant Protection and Quarantine," 203 "Horticulture and Viticulture," 204 "Technology of Production and Processing of Livestock Products," as well as 205 "Forestry," 206 "Horticulture and Landscape Management," and 207 "Aquatic Bioresources and Aquaculture." This is the "heart" of agrarian education, which prepares specialists for direct work in the fields, on farms, and in the processing industry.

2. 21 "Veterinary Medicine." This separate field of knowledge includes specialties 211 "Veterinary Medicine" and 212 "Veterinary Hygiene, Sanitation, and Expertise." It is critically important for ensuring animal health, controlling the quality and safety of products of animal origin, and for the country's biological safety. In addition to these core fields, specialists trained in related consolidated groups and specialties are extremely important for the agricultural sector.

3. 09 "Biology." Provides training for personnel in biological sciences, biotechnologies, genetics, and microbiology—fundamental areas that are the basis for selection, the development of biopreparations, and innovations in the AIC.

4. 10 "Natural Sciences." Especially specialties related to ecology and environmental protection (101 "Ecology"), which are vital for implementing the principles of sustainable agriculture and conserving natural resources.

5. 16 "Chemical Engineering" / 162 "Biotechnology and Bioengineering." Trains personnel for industries that process agricultural products (food industry), as well as for the development of modern biotechnological solutions in the agrarian sector.

6. 19 "Architecture and Construction" (especially specialties related to "Water Engineering and Water Technologies"—the former field 192... "Construction and Civil Engineering." These specialties cover nature management, land reclamation, water use, and irrigation, which are critically important for optimizing agricultural production, especially in the context of climate change.

7. 193 "Geodesy and Land Management." Land management and cadastre specialists play a key role in the effective management of land resources, monitoring their condition, and legal regulation, which is a fundamental basis of the agrarian sector.

These consolidated groups of specialties related to the agrarian sector and related fields account for a significant portion of students who study with state budget funding. According to estimates, this can range from 25% to 35% of the total number of state-funded places in higher education institutions in Ukraine, which underscores the government's priority for the development of the AIC [11].

The consolidated group 07 "Management and Administration" (which includes fields such as "Economics," "Management," "Finance, Banking and Insurance," "Accounting and Taxation," etc.) is an extremely important source of qualified personnel for territories with a developed AIC. This is because graduates of these specialties, having acquired economic and management competencies, are able to work effectively in rural areas, create and lead agricultural enterprises, and develop local

businesses, filling the personnel gaps that often arise due to the relatively low employment rate of graduates from other educational organizations (faculties of classical universities, economic institutes, etc.) directly in rural regions.

Agrarian higher education institutions (HEIs) attach great importance to educational work, realizing their unique social mission and responsibility to society. In the vast majority (over 75-80%) of agrarian universities, there are vice-rectors for educational work as part of the administration, and in the rest, powerful departments and directorates are usually created to organize and coordinate the educational process.

Therefore, it is necessary to identify the main directions of the educational process in agrarian HEIs, which are complex and multifaceted, aimed at forming a comprehensively developed personality. Formation of a system of basic values in young people: This area includes academic integrity, respect for human rights and freedoms, responsibility, ethical norms, and civic consciousness. Patriotic and civic education: This is the development of a deep sense of patriotism, national dignity, love for Ukraine, and a readiness to defend it, which is especially relevant and a priority in the context of the full-scale invasion. This direction also includes fostering respect for cultural heritage and traditions. Education of a personality oriented towards a healthy lifestyle: This involves promoting physical culture, sports, proper nutrition, rejection of bad habits, and forming a responsible attitude toward one's own health.

Labor education: This area forms a diligent and responsible attitude toward work, discipline, and professional ethics, and also helps to realize the importance and prestige of agricultural work for the development of the state.

It is particularly significant that a large portion of students at agrarian universities are from rural areas. Given this characteristic, additional educational goals specific to agrarian education are formed.

Firstly, this includes fostering a love for one's homeland and "small homeland," developing a deep connection to their native region, village, and land, and understanding their value.

Secondly, it is the cultivation of pride in agricultural labor, forming an awareness of the social significance of an agrarian's work, and its key role in ensuring food security and the country's development.

Thirdly, this is a careful attitude toward one's native land and nature as an irreplaceable resource, fostering a high ecological awareness, a sense of responsibility for the preservation of natural wealth, the sustainable use of land and water resources, and an understanding of the non-renewability of natural ecosystems.

Educational institutions with an agrarian profile (most of which are subordinate to the Ministry of Education and Science of Ukraine, but actively cooperate with the Ministry of Agrarian Policy and Food of Ukraine) are not limited to just teaching. They play an extremely important role in providing consulting assistance to agricultural producers and the rural population. This activity is an integral part of their mission as scientific and educational centers. This assistance covers a wide range of issues, such as. Agricultural Production Technologies, which includes consulting on the implementation of innovative crop cultivation technologies, modern methods in animal husbandry, the use of the latest machinery and equipment, and the optimization of production processes to increase yields and productivity. Enterprise Economics, which provides assistance in developing business plans, effective management of financial and material resources, cost optimization, analysis of sales markets, and the search for new niches. Accounting and Agrarian Law, which is intended for consulting on accounting and tax reporting in the agricultural sector, and clarifying legal norms related to land relations, contractual activities, and the specifics of taxation in agriculture.

Agrarian Law, which provides legal assistance and clarification regarding land legislation, lease relations, land ownership rights, and other legal aspects that regulate activities in the agro-industrial complex. Implementation of Innovations and Scientific Developments, which includes the transfer of the latest scientific achievements into the practice of agricultural production, and promotes the use of modern breeding achievements, biotechnologies, and digital solutions for precision farming.

This systematic consulting and scientific-methodological activity of agrarian universities is an integral part of their social responsibility. It contributes not only to increasing the efficiency of agricultural production but also to the sustainable development of rural territories, strengthening the personnel potential of the AIC, and improving the well-being of Ukraine's rural population [16].

Higher education institutions (HEIs) that traditionally have an agrarian profile actively participate in the monitoring of higher education institutions, which is conducted annually by the Ministry of Education and Science of Ukraine (MES) since 2012. These monitoring activities are an important tool for assessing the effectiveness and quality of higher education in the country.

An analysis of the monitoring results, for example, for 2015 (although this information is outdated, it shows trends), indicates that a significant number (around 60-70%) of the agrarian universities that participated in the monitoring (likely over 20 profile HEIs) met four or more key performance indicators. This demonstrates their ability to meet established quality criteria even in challenging circumstances. More recent monitoring conducted by the MES covers a wider range of indicators and is more dynamic, but detailed results broken down by industry are not always published in the public domain.

The level of preparation of applicants entering universities with an agrarian profile is traditionally assessed as being lower relative to the average Ukrainian level, if measured by the average scores of the National Multisubject Test (NMT) or the External Independent Evaluation (EIE) in previous years. Thus, for universities in the agricultural sector, the average NMT/EIE scores are noticeably lower for both state-funded places and tuition-based places. This is explained by several interconnected factors.

Firstly, there is a weaker level of preparation in natural science subjects in rural schools. Objective problems with access to quality education, insufficient material and technical resources, and a lack of qualified teachers in rural areas lead to rural school graduates often having a lower level of knowledge, especially in subjects specific to agrarian specialties (biology, chemistry, mathematics, physics).

Secondly, there is an insufficient level of prestige and relatively low wages for labor in the agricultural sector. Despite the strategic importance of the AIC for Ukraine's economy, there are stereotypes about the low prestige of agricultural professions and the modest level of wages at the initial stages of a career. This leads to a "brain drain" of strong applicants with high scores from the agrarian field to other, in their opinion, more "prestigious" specialties (for example, IT, law, international relations).

Thirdly, demographic and migration processes. The outflow of young people from rural areas to big cities also reduces the number of potential applicants for agrarian HEIs.

Despite these challenges, agrarian universities continue to train high-level specialists. According to recent years' data, approximately 8-10 thousand master's students are studying in around 20-25 agrarian universities in Ukraine, including about 3-5 thousand people with state funding. This indicates a demand for highly qualified specialists in the agricultural sector.

In addition to the quality of applicants, the HEI monitoring also evaluates other important aspects of their activities.

First and foremost is research and development activities (R&D). In recent years, between 10 and 15 agrarian HEIs have exceeded the threshold value for the R&D indicator (the volume of R&D per one academic staff member). This underscores their role as centers for innovation and scientific development for Ukraine's agro-industrial complex, despite often limited funding.

International activity is no less important. Between 5 and 10 agrarian HEIs have exceeded the threshold value for the international activity indicator—the share of foreign students in the total student population. This indicates the growing attractiveness of Ukrainian agrarian education for international students and active integration into the global educational space, although the full-scale invasion has significantly affected these indicators.

Financial and economic activity is also a crucial aspect. Between 7 and 12 agrarian universities have exceeded the indicator for financial and economic activity (university revenue from all sources per one academic staff member). This reflects their

ability to diversify funding sources, attract grants, generate revenue from educational services, and collaborate with businesses.

The demand for graduates in the labor market can also be considered an important indicator. This metric is one of the most significant indicators of an HEI's success. According to the graduate employment monitoring conducted by the MES, the vast majority (over 70-80%) of agrarian universities have met this indicator. This demonstrates a stable demand for agrarian professionals in the labor market, which is proof of the relevance and practical value of agrarian education.

Collectively, these indicators show that, despite certain challenges, Ukraine's agrarian HEIs remain key players in the higher education system, ensuring the training of highly qualified personnel for a strategically important sector of the economy.

In the context of the dynamic changes taking place in the world, particularly in Ukraine, understanding the essence of educational resources, their role, and classification methods is key to forming a high-quality, adaptive, and innovative system for training specialists, especially in such a strategically important field as agrarian education.

The concept of "educational resources" is a fundamental category in pedagogy and educational management. It covers a much broader range of phenomena than just teaching materials or equipment. In a broad sense, educational resources are a comprehensive set of all elements, tools, conditions, potentials, and opportunities that are purposefully used to ensure the effectiveness of the educational process, from planning and teaching to evaluation and administration. It is also important to mention achieving set educational goals, namely the formation of knowledge, skills, and competencies. No less important is meeting the educational needs of the individual and society, training personnel for the labor market, ensuring lifelong learning, and personal development [23].

Educational resources are not only material objects (buildings, equipment) but also information (textbooks, databases, online courses), human potential... (professors, administration, support staff) and methodological developments (programs,

methodologies, technologies). All these elements create an optimal integrated environment for students' learning, development, and self-realization.

Several key aspects can be distinguished that reveal the essence of educational resources. Learning Tools – These are the direct instruments used in the teaching and learning process. This includes textbooks, manuals, multimedia presentations, laboratory equipment, computers, simulators, agricultural machinery for practical classes, etc. Sources of Knowledge – These are carriers of information from which students acquire knowledge. This can be library collections (traditional and electronic), scientific articles, online lectures, video materials, databases, and expert systems. Learning Conditions – A favorable environment that ensures the effectiveness of the educational process. This aspect includes comfortable classrooms, proper lighting, internet access, a psychological climate, and opportunities for independent work and recreation. Development Potential – Opportunities for expanding knowledge, skills, and competencies that go beyond the basic educational program. This includes access to additional courses, training, scientific clubs, internships, and project activities.

For a systematic analysis, design, and effective management of educational resources, it is advisable to classify them according to various criteria. This allows for a more comprehensive consideration of their specifics and functional purpose.

Classification by form of presentation (the nature of the resource) is fundamental because it determines the physical or digital nature of the resources, which directly affects their storage, accessibility, methods of use, and opportunities for integration into the educational process. It allows us to understand their primary nature and physical or intangible form. This division is basic, as it determines the requirements for their creation, storage, distribution, and ultimately, the effectiveness of their use in the educational process.

Three main groups are distinguished: material and technical, informational, and human (personnel) resources. Material and technical resources are all physical objects and infrastructure that ensure the functioning of the educational process. They are tangible and require physical space, maintenance, and regular updating. For agrarian HEIs, this group of resources is particularly critical due to the deeply practice-oriented

nature of the training. The characteristic features of this group are premises and infrastructure: academic buildings and classrooms, classic lecture halls, interactive classrooms, and multimedia rooms. Specialized laboratories: chemical, physical, biological laboratories, agrochemical laboratories (for soil and fertilizer analysis), genetics and breeding laboratories, and microbiological labs. Educational and research farms: their own land plots (fields, gardens, vineyards), greenhouses, and vegetable storage facilities that serve as proving grounds for practical training and scientific research. Livestock complexes and veterinary clinics: modern farms (dairy, meat, poultry), veterinary clinics with diagnostic and surgical equipment, and animal isolation units. Libraries: physical book depositories, reading rooms, and media centers. Sports complexes: gyms, stadiums, and sports grounds. Dormitories and household facilities: providing accommodation and social conditions for students [8].

Equipment and tools are also an important component. This includes agricultural machinery: modern tractors, combines (grain and corn harvesters), sowing complexes, sprayers, soil cultivation equipment, and navigation equipment for precision farming (GPS systems, autopilots). Laboratory equipment: microscopes, spectrophotometers, chromatographs, pH meters, and analyzers for the quality of grain, milk, and meat. Computer equipment: personal computers, laptops, servers, computer networks, projectors, and interactive whiteboards. Veterinary equipment: ultrasound machines, X-ray equipment, surgical instruments, and laboratory equipment for blood analysis and biopsies. Educational models and stands: demonstration models of mechanisms, mock-ups of agricultural crops, animal dummies, and educational stands for diagnosing equipment malfunctions.

We also have to mention visual and hand-out materials (physical): printed materials such as textbooks, study guides, workbooks, atlases, charts, and diagrams; and natural samples, namely herbariums, seed collections, soil samples, minerals, and samples of plant pests and diseases.

Material and technical resources are the basis for practical training, which is irreplaceable in agrarian education. Their modernity and accessibility directly affect the quality of graduates' practical skills and competencies.

Informational resources are structured data, knowledge, and information used in the educational process. They can be presented in various formats, from traditional printed to modern digital ones.

First, there are traditional (printed) resources. These include books and monographs: textbooks, scientific monographs, reference books, encyclopedias, and dictionaries; periodicals: scientific journals, industry newspapers, and bulletins that publish the latest research and news in the agrarian field; and archival materials: historical documents and statistical reports that can serve as a source for research.

Second, there are digital (electronic) resources. This is the most dynamic and rapidly growing group, opening new opportunities for learning. Electronic textbooks and manuals: digital versions of printed publications or original multimedia manuals; online courses (MOOCs, courses on LMS platforms): full-fledged educational programs hosted on distance platforms (Moodle, Google Classroom, Prometheus, Coursera), which include video lectures, interactive tests, forums, and project assignments; video and audio materials: video lectures, educational films, documentary clips about agro-production, podcasts, and webinars; electronic libraries and databases: access to scientific databases (Scopus, Web of Science, Google Scholar), university repositories, and thematic electronic libraries containing scientific articles, dissertations, and conference materials; specialized software: programs for modeling (e.g., plant growth, weather dynamics), GIS systems for field mapping, programs for keeping agricultural records, financial management at an enterprise, and veterinary diagnostics; virtual laboratories and simulators: software complexes that simulate experiments, equipment operation, and skill practice (for example, combine harvester simulators, virtual animal dissections); open educational resources (OER): free learning materials that can be freely used and adapted.

Third, there are methodological resources, such as curricula and syllabi: documents that define the goals, content, sequence, and methods of instruction. Methodological guidelines: for instructors (on conducting classes and evaluation) and for students (on completing independent work and course projects). Case studies and

scenarios: descriptions of real-world agribusiness situations for analysis and problem-solving.

Informational resources provide access to knowledge, allow students to learn at a convenient pace, and promote the development of information retrieval and analysis skills. Digital information resources play a key role in ensuring the flexibility and continuity of education, especially in crisis situations.

Human resources are arguably the most valuable educational resource, as they ensure the functioning and development of the entire educational system. This includes the knowledge, experience, skills, and motivation of the people involved in the educational process.

They include the academic and teaching staff (ATS): instructors, professors, and associate professors. They are the bearers of knowledge, methodologists, and mentors who directly carry out teaching, conduct research, and shape the learning process. Their qualifications, experience (both academic and practical in the AIC), capacity for innovation, and empathy are critically important; researchers: involved in research activities that enrich the learning process with relevant scientific data; invited practitioners: specialists from agricultural enterprises, farmers, and managers who share their practical experience through lectures, master classes, and supervision of practical training [18].

This also includes teaching support staff: laboratory assistants who ensure the preparation and functioning of laboratory equipment; librarians who help with navigating information resources; engineers and technical specialists: they service computer and agricultural equipment and network infrastructure; and agronomists and practicing veterinarians (at educational farms): they work directly with students in the field and on the farm, demonstrating production processes.

Administrative staff, or HEI management: rectors, vice-rectors, deans, and heads of departments who formulate strategy, organize, and manage the educational process; department staff: methodological departments, quality assurance departments, international relations, and graduate employment departments that provide support for the educational process.

And finally, students. Although they are "consumers" of resources, they are also active participants in the educational process, creating a learning environment, and exchanging experience, knowledge, and ideas. Their motivation, engagement, and desire to learn are also valuable resources.

Human resources are the main driving force of the educational process. Their qualifications, interaction, and capacity for innovation determine the quality of education and the formation of professional and personal qualities of graduates. Without qualified personnel the most modern material and technical and informational resources cannot be fully utilized.

It's important to understand that these groups of resources do not exist in isolation. They are closely interconnected and function as a single system. For example, to use digital informational resources (electronic textbooks), you need material and technical resources (computers, internet connection) and human resources (instructors who know how to integrate them and students who are digitally literate). Laboratory research (material and technical resources) is impossible without scientific and methodological informational resources (protocols, theory) and human resources (qualified lab technicians and instructors).

Effective design of educational resources in agrarian HEIs requires a comprehensive approach that considers all forms of presentation, their interaction, and synergy to achieve the maximum quality of the educational process.

Classification by accessibility and ownership is extremely important as it defines the legal status of resources, their funding mechanisms, usage possibilities, and management strategies. In the face of modern challenges, such as financial constraints, the need for quick access to up-to-date information, and integration into the global educational space, understanding these aspects becomes key to the effective functioning of agrarian HEIs.

The classification of educational resources by accessibility and ownership allows us to distinguish who their legal owner is, how they are funded, and how students and instructors can use them. This division is critically important for formulating policies for managing educational resources, planning budgets, and

ensuring equal access to quality education. We distinguish between internal (owned) and external (network) resources, with the latter having several subtypes.

Internal educational resources are all material, informational, and personnel assets that belong directly to the higher education institution (HEI) and are under its operational management and use. This is the foundation upon which the HEI's entire educational activity is built. Characteristic features are direct ownership and management: the HEI is the owner or permanent user of these resources and is responsible for their maintenance, updating, and development. This also includes controlled access: the HEI independently determines the rules and conditions for access to these resources for its students, instructors, and staff. Equally important is funding: primarily from the state budget (for state HEIs), own revenues (tuition fees, R&D activities, property rentals), and charitable contributions [26].

Examples of this type of resource can be considered the material and technical base, i.e., academic buildings, classrooms, laboratories, educational farms, fields, veterinary clinics, research facilities, sports complexes, dormitories, and libraries (physical premises and their collections); equipment, namely agricultural machinery, laboratory instruments, computers, furniture, and tools owned by the HEI; also personnel resources: full-time instructors, professors, researchers, administrative, and teaching support staff; informational resources (created by the HEI): study guides developed by instructors, methodological recommendations, their own electronic courses, a database of the university's scientific works, and software created for internal needs.

The advantages of internal educational resources include ensuring the stability of the educational process, a high degree of control over quality and accessibility, and the ability to adapt resources to the unique educational programs and scientific research of the HEI.

But there are also disadvantages: they require significant investment in maintenance and updating, may be limited by the HEI's financial capabilities, and are prone to physical wear and tear.

External educational resources are resources that do not belong directly to the HEI but can be used in the educational process through various forms of cooperation, licensing, leasing, or open access. Their role is growing in the context of educational globalization and digitalization.

State resources (national level) can be classified by ownership and management. They belong to and are managed by the state (Ministries, agencies, and other state institutions). Access is also an important resource. It is usually provided to educational institutions free of charge or for a symbolic fee, in accordance with state programs or agreements.

Examples of this resource are national libraries and archives, such as access to the collections of the Vernadsky National Library of Ukraine and state archives. This also includes state research institutes. The possibility of conducting research at their facilities and having access to their unique laboratories and equipment (for example, the Institute of Agriculture of the National Academy of Agrarian Sciences of Ukraine). State databases and registers also serve as examples. The land cadastre, registers of agricultural enterprises, and statistical data from the State Statistics Service are valuable for economic and agrarian specialties. We also can't forget about state educational platforms. For example, Diia.Osvita or other educational portals developed with state support.

A special type of resource is private/commercial resources. This group can be classified by ownership and management. They belong to private companies, publishers, and software developers. We also need to mention access as a resource. It is provided on a fee basis, through licenses, subscriptions, leases, or direct purchase [4].

Examples of private resources are scientific databases and publishers, such as access to paid databases of scientific publications (Scopus, Web of Science, Springer, Elsevier), and paid electronic textbooks and periodicals. We should also add specialized software. This includes licenses for the use of professional software for agrarians (e.g., for precision farming, farm management, modeling of agrochemical processes, and statistical data processing). Commercial online platforms can also serve

as examples. They provide access to paid online courses, webinars, and certification programs from private providers. As an example of private resources, we should also mention consulting services. This is the involvement of external experts from the private sector to conduct training and master classes. An equally important type is partner resources, which are defined by ownership and management. They belong to other organizations (enterprises, other HEIs, public associations), but access to them is granted on a contractual basis within the framework of a partnership. Access is also a resource here. It is usually regulated by cooperation agreements, memorandums, and internship contracts. It can be both paid and free (depending on the terms of the partnership).

Examples include production facilities of agricultural enterprises. They are used for internships, on-the-job training, and conducting research using real-world equipment and under production conditions (e.g., large agricultural holdings, family farms). Partner laboratories and scientific centers can also be considered an example. They provide access to unique equipment at another university or research institution. The next example is joint projects and programs. Thanks to them, there is an exchange of students and instructors, and joint development of curricula or scientific research. We should also mention the resources of non-governmental organizations and associations. They provide access to their knowledge bases, expert support, and networks of contacts (e.g., the Farmers Association of Ukraine, industry associations).

The next type of resources is Open Educational Resources (OER). They are usually published under open licenses (e.g., Creative Commons) that allow for free use, adaptation, and distribution. Ownership may remain with the author/organization, but with broad rights for users. Access is also completely free, unrestricted, and open to everyone, without any limitations (other than those provided by the specific open license).

Examples include online courses, courses on platforms like Prometheus, EdEra, and Coursera (in audit format), which offer free access to materials; open textbooks and manuals, electronic publications that are in open access; scientific articles (Open Access), publications in university repositories or open journals; video lectures and

educational channels, materials posted on YouTube, Vimeo, and other platforms; databases and information portals, such as some government or non-profit portals that provide free access to statistical data, maps, and thematic information. An effective educational resource system of a modern agrarian HEI should be based on a balanced combination of all these categories. This means maximizing the use of internal resources and investing in their updating and development. It also means actively engaging external resources, entering into partnerships with businesses, using state databases, licensing commercial software, and integrating OER. We must also remember to diversify sources and reduce dependence on one type of resource, which increases the system's resilience, especially in crises. An important factor is the management of access rights and licensing, a clear understanding of the legal aspects of using external resources.

Classification by functional purpose is key to understanding what specific goal or function a particular resource performs in the overall system of higher education. It allows us to evaluate not just the availability of resources, but their ability to support various aspects of the HEI's activities—from direct instruction to scientific research and administrative management. For agrarian HEIs, where processes are interconnected and have a clear focus, this is particularly relevant.

The classification of educational resources by functional purpose allows them to be categorized by the main role they play in achieving the goals of the higher education institution. These are not mutually exclusive categories, and often the same resource can perform several functions. However, their division by a dominant function helps to systematically plan, allocate, and use resources for the most effective support of the different types of HEI activities. Four main groups are distinguished: learning, scientific, educational, and administrative (management) resources.

Learning resources are all the tools, materials, and conditions that are used directly for carrying out the educational process, and for forming students' knowledge, skills, and competencies. Their main purpose is to ensure the effectiveness of teaching and learning disciplines in accordance with educational programs. The characteristic features of these resources are direct use in learning activities. They are created and

adapted specifically for didactic purposes. They are also focused on learning outcomes, which contributes to achieving specific program learning outcomes.

Examples include didactic materials, such as textbooks, study guides (printed and electronic), methodological guidelines for laboratory and practical work, collections of tasks, case studies, atlases, maps, and handouts. They also include technical teaching aids, such as projectors, interactive whiteboards, computers, and software for modeling, simulation, and graphic design, which are used in classes. We should also mention educational equipment and infrastructure, such as classrooms, computer labs, specialized teaching laboratories (e.g., for agrochemical analysis, microbiology), educational farms, fields, and veterinary clinics that are used for practicing skills. Educational simulators and trainers, virtual simulators of agricultural machinery, interactive models of animal physiological processes, and programs for diagnosing plant diseases can serve as examples. Instructors as bearers of methodologies play a very important role. The knowledge and experience of instructors in conducting lectures, seminars, and practical classes, and organizing students' independent work are difficult to overestimate. Another example of learning resources is online courses and LMS platforms, and distance learning modules that contain educational content, tests, tasks, and communication forums.

Learning resources are the core of the educational process. Their relevance, accessibility, and compliance with the latest industry requirements determine the quality of professional training for graduates, especially agrarian specialists who need strong theoretical knowledge and practical skills.

Scientific resources are the means that ensure the conduct of scientific research, development, experiments, and innovative activities in the HEI. Their purpose is to generate new knowledge, develop science and technology, and integrate scientific activity into the educational process. Their characteristic features are a focus on research and innovation. They are used to obtain new scientific results, not just to transmit existing knowledge [12].

Examples of these resources include specialized and high-tech equipment, namely research laboratories, labs for complex analyses of soil, plants, and livestock

products, genetic research, and biotechnological developments (e.g., mass spectrometers, PCR machines, sequencers), experimental plots and testing grounds, specially designated territories for conducting field experiments, testing new plant varieties, agricultural technologies, studying the influence of various factors on yields, and monitoring equipment, such as drones with multispectral cameras, weather stations, and satellite data for agricultural monitoring. Informational resources for scientists also serve as examples. They provide access to scientific databases like Scopus, Web of Science, and Google Scholar, as well as specialized databases in agrarian sciences. This also includes scientific library collections, monographs, dissertations, scientific journals with the latest research, software for scientific calculations, statistical packages, and programs for modeling complex biological and agrarian systems.

Finally, there are personnel resources, namely researchers, postgraduate students, doctoral students, and professors who are actively engaged in scientific activities and publish research results.

Scientific resources are a source of innovation that ensures the relevance of the educational process. They allow for the integration of the latest research results into curricula, and for involving students in scientific work, thereby forming their research competencies and critical thinking. For agrarian education, this means training specialists who are capable of implementing the latest technologies and developing the industry.

Educational resources are all the tools, conditions, and opportunities that are used to shape students' personal qualities, worldview, values, civic stance, and social responsibility. Their purpose is the comprehensive development of the individual, adaptation to the social environment, and the formation of an active citizen. The characteristic features are a focus on personal development. They influence the emotional, value, and behavioral spheres of students.

Examples of such resources are the social and cultural environment, namely dormitories, as a space for socialization and community building, sports complexes and sections, which are created for the development of physical culture and a healthy

lifestyle, cultural centers and student clubs, namely theater groups, choirs, and dance ensembles, where students can develop their talents, and university museums and historical expositions, which contribute to the formation of respect for the history of the university, the industry, and national traditions.

Another example of educational resources is the activities of student self-government, which provides opportunities for students to participate in the management of the HEI, organizing events, and developing leadership qualities.
Personnel resources also play an important role, namely vice-rectors for educational work, group curators, psychologists, and social educators who provide moral support, counseling, and organize educational events. Volunteer and social projects can also be considered educational resources. They ensure students' participation in community service and environmental initiatives, which shape social responsibility (especially relevant during wartime).

Finally, we cannot ignore informational resources. This includes literature on ethics, psychology, civic education, and materials on national-patriotic education.

Educational resources are an integral part of the educational process, especially for agrarian HEIs, where fostering a love for the land, work, and a responsible attitude towards nature is key. They form a well-rounded individual who not only possesses professional knowledge but is also a responsible citizen.

Administrative (management) resources are the means that ensure the effective functioning, planning, organization, coordination, and control of all processes within an HEI. Their purpose is to support and optimize educational, scientific, and educational activities.

Their characteristic features are support and ensuring functionality. They are created for the effective management of the HEI's activities. First and foremost, this is personnel resources, namely the HEI's management, the rector's office, dean's offices, department heads—the individuals who make management decisions. The staff of administrative departments, such as HR, accounting, the legal department, the planning and finance department, the chancellery, and the licensing and accreditation

department, play a very important role in ensuring document flow, financial operations, and legal support.

Administrative resources also include management information systems, namely electronic document management systems to automate administrative processes, student information systems (SIS) for student records, scheduling, grade management, databases of students, faculty, financial operations, and scientific projects, and network infrastructure, i.e., corporate networks, servers, and cloud storage for administrative data.

We cannot overlook the regulatory and legal framework: Laws of Ukraine, resolutions of the Cabinet of Ministers, orders of the Ministry of Education and Science, the HEI's charter, and internal regulations and instructions that govern all aspects of its activities.

Finally, financial resources play a crucial role, namely state budget funds, internal revenues, grants, and sponsorship, which ensure financial stability and development.

Administrative resources are the "invisible framework" of the HEI, ensuring the coordinated work of all its departments. Their effectiveness directly impacts the quality of the educational, scientific, and educational processes, ensuring their compliance with legal requirements, financial transparency, and strategic development planning.

It is important to emphasize that these functional groups of resources are closely interconnected. For example, high-quality learning resources (modern laboratories) depend on administrative resources (effective funding and management) and scientific resources (the integration of the latest developments). Educational resources (organizing sports events) require a material and technical base (sports halls) and administrative support [25].

Thus, an effective system for managing educational resources in an agrarian HEI involves not only their availability but also the harmonious integration and interaction of all functional groups to achieve a holistic and high-quality educational outcome.

Classification by form of use is particularly relevant in the context of the rapid development of information technologies and the transformation of educational

processes, including the implementation of distance and blended learning. It determines how exactly the student interacts with the resource and where this process takes place.

The classification of educational resources by form of use focuses on the ways they are applied in the educational process and their accessibility for students. This criterion is key to understanding the logistics, technological requirements, and pedagogical effectiveness of resources in different educational models (in-person, distance, blended). Three main forms of use are distinguished: classroom, distance, and for independent work, although there are often synergies and overlaps between them.

Classroom educational resources are all the tools, materials, and conditions that are used directly in the learning process that takes place in physically defined educational premises (classrooms, laboratories, workshops, training grounds, etc.) in the presence of an instructor and a group of students. This is the traditional form of resource use that ensures direct interaction. The characteristic features are direct physical interaction. Resources are used "here and now" during the class. Another feature is a controlled environment, meaning the instructor has full control over the use of the resource and the learning process.

The main examples of classroom resources are the material and technical base, namely equipped classrooms, computer labs, specialized laboratories (chemical, physical, biological, agrochemical), educational farms, fields, veterinary clinics, agricultural machinery (tractors, combines) for practical training, and research training grounds. Examples should also include visual aids, such as boards (classic, interactive), projectors, demonstration models, dummies, herbariums, collections of soil or plant samples, and microscopes with prepared slides. Printed materials also serve as examples. These are textbooks, workbooks, handouts, tables, charts, and diagrams used directly during lectures or seminars. One example is the instructor as a resource, on whom the live lecture, seminar, discussion, direct supervision of practical work, or demonstration depends. An equally important example is collaborative work, namely group projects and discussions that require physical presence and the joint use of classroom resources.

The advantages of classroom resources include providing a deep immersion in the material, the possibility of immediate feedback, the development of communication skills, community building, and effective practice of skills on real equipment.

But there are also disadvantages, such as being limited in time and place, the need for physical presence, and the high cost of maintaining the material and technical base.

Distance learning resources are those tools, materials, and opportunities that are available to students remotely, without the need for their physical presence at a specific place and time. They are the basis for implementing distance learning and to a large extent, blended learning. Their characteristic features are remote access, meaning access to resources via the internet or other network technologies. This also includes flexibility in time and place, as students can study at a time that is convenient for them and from any location.

Examples of distance resources are more than sufficient. This includes electronic learning courses (MOOCs, LMS courses), hosted on educational platforms (Moodle, Google Classroom, Coursera, Prometheus), which contain lectures (text, video, audio), presentations, assignments, tests, and discussion forums. This also includes video and audio materials, video lectures, seminar recordings, podcasts, educational films, and documentary clips about agro-production. We can also mention electronic libraries and databases, providing access to scientific articles, monographs, and periodicals in digital form (for example, through subscriptions to Scopus, Web of Science or access to university electronic libraries). This also includes virtual laboratories and simulators, software complexes that imitate the operation of equipment and the conduct of experiments (for example, modeling chemical reactions, plant growth processes, and agricultural machinery operation). Specialized software should also be included here, such as programs for GIS analysis of land plots, agronomic planning, and zootechnical accounting, which are accessible to students remotely. Finally, there are online consultations and webinars, synchronous interaction with the instructor or peers via video conferencing (Zoom, Google Meet).

The advantages of distance resources include accessibility for a wide range of users (especially important during war, pandemics, for people with disabilities), flexibility of learning, the possibility of reusing materials, updating content, and reducing logistics costs.

The disadvantages can be the need for a stable internet connection and technical means, a potential decrease in the level of socialization, and difficulties in practicing some practical skills without real equipment.

Educational resources for independent work are those materials and tools that are intended for individual, autonomous study of material by the student outside of classroom sessions and without direct supervision from an instructor at the moment of use. They are key to developing self-learning skills and continuous professional development. The characteristic features of this resource are autonomy, meaning the student independently determines the pace, sequence, and depth of study. This also includes the development of self-organization. This resource stimulates the development of skills for planning, controlling, and evaluating one's own learning activities.

We encounter examples of resources for independent work at every turn. Firstly, these are textbooks and study guides (printed and electronic); they are the main sources for studying theoretical material. Secondly, these are problem books and exercise collections for practicing calculation and analytical skills. Also, there are case studies and problem assignments for independent situation analysis and solution finding. Reference materials are very often used, namely encyclopedias, dictionaries, glossaries, and online reference books. No less important is recommended literature, namely lists of additional sources for in-depth study. An example of this type of resource is project assignments, i.e., the completion of individual projects and term papers that require independent information retrieval and systematization. This also includes web resources and open educational resources (OER), which provide access to online libraries, open courses, educational portals, and thematic blogs and forums. Finally, there is software in the form of programs for statistical analysis, modeling, and presentations that students use individually.

This type of resource develops self-reliance, critical thinking, information retrieval and analysis skills, and allows students to deepen their knowledge on specific topics and adapt the pace of learning to individual needs.

However, at the same time, it requires a high level of self-discipline and motivation and can be less effective without proper methodological support and feedback.

It is important to note that in modern educational practice, especially in the context of blended learning, different forms of educational resource use are closely intertwined and complement each other. For example, video lectures (a distance resource) can be used as preparation for a classroom practical session, and independent work assignments can be completed using both classroom and distance resources. For agrarian HEIs, such integration is especially valuable. For example, the theory of working with modern agricultural machinery can be studied remotely using videos and simulators, while the direct practice of skills can be done on real equipment at a training ground (a classroom resource).

Thus, the effective design of an educational resource system requires considering all forms of their use, maximizing their advantages, and minimizing their disadvantages to ensure comprehensive and high-quality specialist training.

The classification of educational resources can be observed in Table 3.

Table 3

Classification of Educational Resources by Various Criteria

Classification criterion	Categories (types) of educational resources	Description and examples (for agricultural HEIs)
1. By format / type of information presentation	Textual	Textbooks, manuals, lecture notes, articles, methodological guidelines, regulatory documents.
	Visual	Illustrations, diagrams, charts, infographics, photographs of crops/animals/equipment, maps, presentations.
	Audio	Audio lectures, podcasts (for example, interviews with successful farmers), audiobooks, sound files (sounds of machinery, animals).

Continuation of table 3

	Video	Video lectures, demonstrations of technological processes (sowing, harvesting), video instructions, documentaries, virtual farm tours.
	Multimedia / Interactive	Electronic textbooks, online courses (MOOCs), virtual laboratories, simulators, interactive tests, games, web quests, 3D models (machinery, plants).
2. By degree of interactivity	Passive	Textbooks, videos, audio lectures, presentations (without the possibility of interaction).
	Partially interactive	Electronic summaries with links, multiple choice tests, videos with pause elements for questions.
	Actively interactive	Virtual trainers, simulators (where the student's actions affect the outcome), games, online labs, chat rooms/discussion forums, project assignments.
3. By the degree of adaptation to the user	Static	Resources with fixed content that do not change under the influence of user actions.
	Dynamic / Adaptive	Resources that change content, difficulty level, or offer personalized learning trajectories based on a student's performance, interests, or knowledge gaps (e.g., AI-adaptive systems).
4. By access/distribution method	Offline resources	.Printed publications, CD/DVDs, local network resources of the university that do not require an Internet connection.
	Online resources	Resources available via the Internet (websites, LMS platforms, cloud storage, YouTube channels).
	Closed / Protected	Resources available only to authorized users (e.g., through LMS with university login/password).
	Are open (Open Educational Resources - OER)	Resources that are in the public domain or distributed under an open license (e.g., Creative Commons) are available for free use, adaptation, and distribution.

Continuation of table 3

5. By purpose / functionality	Theoretical	Educational materials for mastering fundamental knowledge (lectures, textbooks). Educational materials for mastering fundamental knowledge (lectures, textbooks).
	Practical	Collections of problems, laboratory exercises, virtual simulators, cases, sample documents to fill out.
	Controlling	Tests, quizzes, self-assessment questions, assessment cases, assessment criteria.
	Reference / Auxiliary	Glossaries, dictionaries, reference books, databases (e.g., on plant varieties, animal breeds, diseases).
	Problem / Case studies	Sets of real or simulated problem situations (case studies) for analysis and resolution, often taking into account crisis experience.
6. By source of creation/development	Author's (own)	Developed by teachers of a specific higher education institution.
	Adapted	Existing resources modified and adapted to the needs of a specific course or HEI.
	Typical / Standard	Developed centrally (MES, industry associations) for widespread use.
	Commercial	Licensed resources purchased from third-party developers (e.g., modeling software).
7. By structure	Holistic course	A full-fledged electronic course with all components (lectures, practical, control).
	Module / Section	A separate, completed part of a course or discipline.
	Individual element	Video lecture, test, simulator, separate article.

Thus, educational resources are not just a passive set of tools but a dynamic, interconnected system that is a key element of the viability and development of any educational institution. For agrarian HEIs, which are focused on forming practical competencies and are closely integrated with the real agro-industrial complex, understanding and effectively managing these resources is the key to successfully training highly qualified specialists. In the context of modern crisis situations, the role

of flexible, digital, and adaptive educational resources takes on special significance, allowing for the continuity and quality of the educational process.

The educational resources of agrarian higher education institutions (HEIs) have a number of unique features that distinguish them from the resources of classical universities or technical institutions. These features are due to the deep practical orientation of the training and the inseparable connection with the agro-industrial complex (AIC), which is a key sector of the Ukrainian economy.

First and foremost, we need to single out practical orientation as a guiding principle. This includes educational fields and open-air laboratories. Unlike theoretical disciplines, agrarian specialties require constant work with living objects (plants, animals) and real production processes. The educational resources of agrarian HEIs include their own educational and research farms, demonstration fields, orchards, greenhouses, modern livestock complexes, veterinary clinics, and nurseries. This allows students to practice skills in crop cultivation, animal care, and the use of fertilizers and plant protection products in real-world conditions, not just in classrooms.

Modern agricultural machinery also plays a big role. For the training of agricultural engineers and machine operators, access to a wide fleet of modern agricultural machinery and equipment is vital. This includes not only tractors and combines but also navigation equipment and precision farming systems (GPS trackers, drones, agrochemical analyzers), which are an integral part of the educational process. Students have the opportunity to study their design, operating principles, and practice driving and maintenance skills.

Internships and practical training are no less characteristic. An important part of educational resources are informal resources, such as established connections with agricultural enterprises. This provides an opportunity for internships and diploma projects at real farms. Thanks to this, students gain experience working with modern technologies and get acquainted with the production culture and business specifics.We also shouldn't forget about case methods and project-based learning. Educational programs actively use real cases and projects from the practice of the AIC. Students work on solving problems faced by agricultural enterprises (for example, optimizing

crop rotation, developing a business plan for a farm, implementing new processing technologies), developing critical thinking, and teamwork skills.

It is very important to maintain an inseparable connection with the agro-industrial complex. First, this is the updating of training content. The connection with the AIC allows for continuous updating and revision of the content of educational programs and, accordingly, educational resources. This is ensured through cooperation with leading agricultural companies, associations, farms, and industry experts who participate in the development of curricula and the conduct of lectures and master classes. Thus, educational resources reflect the latest trends, innovations, and challenges of the agrarian sector.

Second, this is a research base oriented towards the AIC. Agrarian HEIs have unique research laboratories, selection centers, and biotechnological complexes that often work to solve specific problems of the AIC—the development of new plant varieties and animal breeds, the diagnosis of diseases, and the optimization of soil conditions. These scientific developments are an integral part of educational resources, integrating into the educational process through lectures, practical classes, and term papers/theses.

Third, this is consulting and knowledge transfer. Agrarian HEIs act as consulting and expert centers for local agricultural producers. They provide access to their resources (the knowledge of instructors, laboratory capabilities, and research results) to solve practical problems of the AIC and organize seminars and training sessions. This ensures a two-way connection: HEIs receive relevant tasks for research and training, and the AIC receives new knowledge and solutions.

Finally, this is personnel provision and labor market demand. Educational resources are formed taking into account the constantly changing needs of the AIC labor market. This means that, for example, library collections are replenished with specialized literature, and computer labs are equipped with programs used in agricultural production (for example, for farm management, yield forecasting, and agricultural logistics).

Thus, the specificity of the educational resources of agrarian HEIs lies in their deep integration with the real sector of the economy, which ensures the high quality of training of specialists ready for the challenges of the modern agro-industrial complex. They are not just educational institutions but key infrastructural elements for the sustainable development of rural areas and the country's food security.

The quality of agrarian education is not just about having a diploma but about the ability of graduates to work effectively in the dynamic agro-industrial complex, implement innovations, and ensure the country's food security. In this context, educational resources play an absolutely critical, multifaceted role, serving as the foundation for training highly qualified specialists. Here is how educational resources affect the quality of agrarian education:

1. Formation of Modern Practical Skills and Competencies

Access to up-to-date equipment and technologies. The availability and regular updating of modern agricultural equipment, machinery, and laboratory facilities (For soil science, product quality analysis, disease diagnostics for plants and animals) allows students to gain experience working with the instruments they'll encounter in real production environments. Without this, theoretical knowledge remains abstract. Educational farms and training grounds also have an impact. The HEIs' own educational and research fields, farms, veterinary clinics, and greenhouse complexes are irreplaceable "living laboratories." They allow students to not only study but also directly participate in the full cycle of agricultural production—from sowing to harvesting, from animal care to veterinary procedures. This forms a deep understanding of the processes and develops practical skills. Production internships and practical training. Strong partnerships with agricultural enterprises, farms, and research institutions in the AIC are a key educational resource. They provide places for internships, allowing students to integrate into a real work environment, apply the knowledge they've gained, and form professional competencies under the guidance of experienced specialists.

2. Ensuring the Relevance and Innovativeness of Knowledge

Availability of up-to-date information sources. Access to modern electronic libraries, scientific databases, specialized periodicals, and analytical reports on the AIC is vital. This allows students and instructors to stay abreast of the latest scientific achievements, technological innovations, and market trends in the industry, which is the key to training specialists who are capable of adaptation and development. Digital educational platforms and simulations. The use of virtual laboratories, online simulators, agricultural machinery simulators, and precision farming software allows for the imitation of complex production processes and experiments. This not only increases the effectiveness of learning but also makes it more accessible, especially in crisis situations or with limited access to real equipment. The experience and knowledge of instructors also have an impact. Highly qualified academic staff are one of the most valuable educational resources. Instructors who have practical experience, are engaged in research, and constantly improve their qualifications pass on not only academic knowledge but also relevant insights and critical thinking skills that are the result of their interaction with the AIC.

3. Promoting Research and Innovation

Scientific research infrastructure. High-quality laboratories, experimental plots, and research centers are resources that allow students, master's students, and doctoral students to conduct their own research. This stimulates the development of scientific potential and forms skills for independent work and finding solutions to pressing problems in the agricultural sector. Projects and grants. Participation in scientific projects and grants and cooperation with businesses in the framework of research is an important resource for the development of HEIs. This not only provides additional funding but also integrates the educational process with the real needs of the industry, allowing students to work on practically significant tasks.

4. Ensuring Accessibility and Flexibility of Education

Distance learning technologies. In crisis situations, the availability of developed systems distance learning (LMS platforms, video conferencing), electronic learning materials, and online courses is a critically important resource. They ensure the

continuity of the educational process, allowing students to study from any location, overcoming geographical and security barriers. This also includes inclusivity. The diversity of educational resources (both material and digital) contributes to the creation of an inclusive educational environment that takes into account the different needs of students, including those with special educational needs or limited access to traditional forms of education.

Thus, educational resources are not just auxiliary elements but a system-forming factor in the quality of agrarian education. Their accessibility, relevance, diversity, and effective use determine how well an HEI can prepare specialists capable of meeting the demands of the modern agro-industrial complex and working successfully in a context of constant change and challenges.

The design of educational systems and resources is a complex process that requires deep theoretical justification. Effective design is based on the use of various scientific approaches that allow for structuring activities, taking into account all interconnections, and ensuring the achievement of set goals. Among the key approaches that form the basis for designing educational systems and resources, the systems approach, competency-based approach, and innovative approaches are distinguished.

The systems approach is fundamental for designing any complex object, especially educational systems and their resources. It views the object of study or design as a holistic system consisting of interconnected components, functioning in a specific environment, and having a specific goal.

Key principles of the systems approach in the context of designing educational resources. Holism: Educational resources are not seen as separate elements (e.g., a textbook and a laboratory separately) but as a single interacting complex. Changes in one component (e.g., updating the curriculum) must be considered when designing others (e.g., the need for new equipment or digital materials). It's important to understand that the quality of a system is determined not by the sum of the qualities of its parts, but by the effectiveness of their interaction. Structure: The system of educational resources has a clear internal structure and hierarchy. This means

distinguishing subsystems (e.g., material and technical resources, informational resources, human resources), their connections, and interdependencies. Design involves a clear definition of the role of each resource and its place in the overall system. Interconnection with the external environment: Educational resources do not exist in a vacuum. They are influenced by the external environment (e.g., the demands of the AIC labor market, state educational policy, technological progress, crisis situations). The systems approach requires taking these influences into account and adapting resources to changes in the external environment. For example, the emergence of new agricultural technologies requires the updating of learning materials and equipment. Hierarchy: Every system is part of a larger system (a supersystem) and can itself consist of subsystems. The educational resources of an HEI are a subsystem of the HEI's educational system, which, in turn, is part of the national education system. This allows for designing resources at different levels, considering the general goals and the specifics of a particular level.

Dynamism and development: The systems approach views educational resources not as static objects but as elements that are constantly developing and adapting. The design should provide mechanisms for monitoring, evaluating, and updating resources to maintain their relevance and effectiveness in a context of constant change.

Stages of Applying the Systems Approach in Designing Educational Resources:

1. Defining the design goal: Clearly formulate what educational goals should be achieved with these resources (e.g., training specialists capable of implementing precision farming technologies).
2. Analyzing the current system: Evaluate existing educational resources, identify their strengths and weaknesses, "bottlenecks," and resource deficiencies.
3. Defining resource requirements: Formulate the criteria that new or updated resources must meet (e.g., interactivity, accessibility, relevance, compliance with standards).
4. Designing the resource structure: Develop a model of interaction between different types of resources (material, informational, personnel).

5. Development and implementation: Create or modernize specific educational resources (e.g., develop an online course, purchase new equipment, improve the qualifications of instructors).

6. Monitoring and evaluation: Constantly monitor the functioning of the resources, collect feedback, and analyze their effectiveness and compliance with the set goals.

7. Correction and updating: Make changes to the resource system based on the results of monitoring and evaluation, ensuring its adaptability to new challenges (especially important in crisis situations).

The advantages of the systems approach for agrarian HEIs include. Comprehensiveness: It allows for taking into account all aspects and interconnections between different types of resources, which is critically important for practice-oriented agrarian education (where, for example, effective practical training is impossible without a high-quality laboratory). Optimization: It helps to rationally use existing resources and effectively plan new investments. Adaptability: It promotes the rapid adaptation of educational resources to the changing needs of the AIC and the external environment, including crisis situations (for example, the transition to distance learning required a systematic approach to resources). Forecasting: It allows for predicting potential problems and resource needs, which is important for the long-term planning of the development of agrarian education.

Applying the systems approach to the design of educational resources in agrarian HEIs is the key to creating an effective, adaptive, and innovative educational system capable of training highly qualified specialists for the needs of the modern agro-industrial complex of Ukraine.

After the systems approach, which defines the general structure and interconnections, the competency-based approach becomes key for filling the content of educational resources. It is a paradigm in education that focuses not so much on the amount of knowledge acquired as on the graduate's ability to apply this knowledge, skills, and abilities to successfully solve professional and life tasks in real-world

conditions. For agrarian education, which is deeply practice-oriented, the competency-based approach is absolutely indispensable.

Unlike the "knowledge-based" paradigm, which focuses on the transfer of information, the competency-based approach reorients education towards the result—the formation of competencies. A competency is a dynamic combination of knowledge, skills, abilities, ways of thinking, views, values, and other personal qualities that determines a person's ability to successfully engage in professional and/or further educational activities.

How the Competency-Based Approach Shapes the Content of Educational Resources in Agrarian HEIs. Defining key and subject-specific competencies. The first step is to clearly define which key competencies (e.g., critical thinking, communication, lifelong learning ability) and special (subject-specific) competencies (e.g., the ability to diagnose plant diseases, design irrigation systems, operate agricultural machinery) are necessary for a graduate to be successful in the modern AIC. This is done by analyzing higher education standards, professional standards, employer needs, and by cooperating with representatives of agribusiness. Educational resources are then developed or adapted to directly facilitate the formation of these competencies. Designing application-oriented tasks. The focus shifts from memorizing information to solving problems and cases. Educational resources (textbooks, methodological guides, assignments for practical work) contain not only theoretical information but also real-world situations from agricultural production, project assignments, and simulations that require the student to apply knowledge in non-standard conditions. For example, instead of simply describing plant diseases, a resource might contain an interactive case where the student must independently diagnose a disease based on photos/videos, determine the cause, and propose a treatment plan. Emphasis on interactive and practical resources. Laboratory and field equipment are not just tools for demonstration but active resources where students perform practical research, experiments, and analyses (e.g., analysis of soil, water, grain quality, and diagnosis of plant and animal diseases). Production internships and practical training become central, as it is in production that students gain real-world experience applying their

knowledge and developing practical competencies. This is not just a visit to a farm but the completion of specific production tasks. Simulators and virtual laboratories are digital resources that allow for the safe and repeated practice of complex professional skills (e.g., operating a combine, diagnosing equipment malfunctions, performing veterinary operations), and they are an integral part of competency formation. Specialized software—resources that include software for managing an agricultural enterprise, GIS systems for field mapping, and programs for modeling agrochemical processes—form digital competencies. Integration of Knowledge from Various Disciplines. Modern agricultural problems are rarely solved within the confines of a single discipline. The competency-based approach encourages the creation of integrated educational resources that combine knowledge from agronomy, engineering, economics, and ecology. For example, a resource for a "smart farm" project would require knowledge of automation, crop production, economics, and management. Competency-Oriented Assessment. Educational resources include assessment criteria that focus on the ability to apply knowledge (e.g., project evaluation, skill demonstration on simulators, case defense), not just on the reproduction of knowledge.

Advantages of the Competency-Based Approach for Agrarian HEI Educational Resources. Relevance to the labor market: Graduates are a better fit for the modern AIC's requirements, as their training is directly aimed at developing sought-after competencies. Practical focus: The content of the resources becomes more practical and applicable, which increases student motivation.

Flexibility and adaptability: Educational resources created on a competency basis are easier to adapt to new technologies and challenges (including crisis situations) because the focus shifts to the ability to solve problems rather than memorizing specific facts.

Improved quality of education: The systematic formation of competencies ensures a higher quality of training for specialists who are capable of working effectively and developing in their professional field. The competency-based approach encourages students to independently seek knowledge and develop self-learning skills for continuous professional growth.

Thus, the competency-based approach is not just a methodological principle but a philosophical basis for forming the entire complex of educational resources of an agrarian HEI. It transforms textbooks, laboratories, field plots, and even the organization of practical training into tools that purposefully work to develop specific, in-demand competencies of future agricultural professionals.

In today's rapidly changing world, especially in crisis situations, traditional approaches to designing educational resources are no longer sufficient. Innovative approaches borrowed from the business and technology sectors, such as design thinking and Agile methodologies, are taking their place. These approaches allow for the creation of educational resources that are not only relevant and effective but also flexible, user-oriented (for both students and instructors), and capable of rapid adaptation.

Design thinking is a human-centered approach to innovative problem-solving that relies on understanding user needs, generating ideas, prototyping, and testing. Its application in education allows for the creation of educational resources that truly meet students' needs and are engaging and effective.

Design Thinking Stages and Their Application in Designing Educational Resources for Agrarian HEIs. Empathize: This involves a deep understanding of the needs, motivations, problems, and challenges of the users (agrarian students, instructors, and future employers in the agro-industrial complex). This stage includes conducting interviews, observing the learning process, and analyzing difficulties. For example, it might reveal that students lack interactive simulators for fieldwork or that instructors need ready-made online case studies from real agricultural enterprises. Define: Based on the data from the empathy stage, you clearly formulate the problem to be solved. For instance, "How can we create accessible and interactive resources for the practical training of agronomists when access to real fields is limited?" or "How can we develop an online course in veterinary medicine that ensures a sufficient level of practical skills?" Ideate: This is a brainstorming phase to generate as many diverse ideas as possible to solve the defined problem without evaluating them. Ideas might include developing a virtual farm, creating a mobile app for diagnosing plant diseases,

video courses on operating agricultural machinery, gamified assignments on agribusiness economics, or using augmented reality to study animal anatomy. Prototype: This stage involves quickly creating a rough, low-cost version of a chosen idea that can be tested. This could be a mock-up, a sketch, a simplified digital version, a demo of a virtual combine simulator, a storyboard for a video lesson, or a basic module for an online course. Test: In this final stage, you test the prototype with real users, gather feedback, and identify shortcomings and opportunities for improvement. This includes having students use the prototype and collecting their feedback, asking instructors about the convenience and effectiveness of the resource, and measuring engagement and success metrics. Based on the results, the prototype is improved, and the process can be repeated cyclically.

Advantages of Design Thinking for Agrarian HEIs. Human-centered approach: Educational resources are created with the real needs and capabilities of students and instructors in mind, increasing their motivation and engagement. Innovativeness: It promotes the generation of creative and non-standard solutions for complex educational tasks. Effectiveness: Through continuous testing and iterations, resources become higher quality and more functional. Risk reduction: Prototyping and testing in the early stages allow for the identification of shortcomings before significant investments are made.

Agile methodologies (e.g., Scrum, Kanban) are a set of development principles based on an iterative and incremental approach, flexibility to change, a focus on customer value, and continuous team collaboration. Borrowed from software development, they are perfectly suited for the dynamic creation of educational resources, especially in uncertain conditions (like crisis situations).

Key Principles of Agile and Their Application. Iterative Development (Sprints): Instead of one long development process, the work is broken down into short, time-boxed iterations, or "sprints." Each sprint results in a working, albeit incomplete, product fragment. For example, a team developing an online course might use a sprint to create the first one or two modules with basic materials and tests. The next sprint would add interactive exercises, and the third might integrate a virtual laboratory. This

allows for the rapid release of a Minimum Viable Product (MVP)—such as a basic study guide—that is continuously supplemented and improved. Flexibility to Change: Unlike traditional "waterfall" models, Agile welcomes changes to requirements even at late stages of development. If new challenges arise (e.g., a change in agricultural legislation, the emergence of new pests, or a crisis affecting internet access), Agile allows for a quick reorientation of resource development to meet new competency needs or formats. Continuous Collaboration and Communication: The development team (instructors, methodologists, IT specialists, and designers) constantly collaborates with each other and with "clients" (students, employers). Regular "stand-up" meetings to discuss progress and problems, as well as involving students for feedback at every stage, ensure that the resource meets needs and responds quickly to challenges. Focus on User Value: The main priority is to deliver value to the user as quickly and effectively as possible. Educational resources are created with a clear understanding of the problem they solve for the student (e.g., "allows you to practice skill X," "provides access to information Y").

Advantages of Agile Methodologies for Agrarian HEIs. Speed of Development and Implementation: This methodology allows for the rapid creation and provision of necessary resources (e.g., online courses for distance learning). Adaptability to Unforeseen Circumstances: It helps HEIs easily adapt to changing conditions, such as a sudden transition to distance learning or shifts in the needs of the agro-industrial complex due to a crisis. High Quality: Thanks to continuous testing and feedback, the final resources are of higher quality and more functional. Efficient Resource Use: Agile avoids lengthy "on-the-shelf" development by focusing on the functions that provide the most value.

By applying design thinking and Agile methodologies, agrarian HEIs can move beyond simply creating educational materials. They can develop dynamic, flexible, and high-quality educational products that meet the challenges of the modern world and effectively form the necessary competencies for future professionals in the agro-industrial complex.

The development of the agricultural sector today is inextricably linked to innovation and knowledge. In this context, educational resources play a key role in training qualified specialists, implementing the latest technologies, and increasing agricultural productivity. International experience shows a variety of approaches to creating and using such resources, which can be classified into several main areas.

1. Digital Educational Platforms and MOOCs (Massive Open Online Courses)

One of the most notable trends is the development and active use of digital educational platforms. They provide access to a wide range of courses, lectures, webinars, and learning materials, allowing farmers, agronomists, and students to acquire knowledge regardless of their geographical location.

Examples of their use are more than sufficient. First of all, there are Coursera and edX, which offer numerous courses on agronomy, agricultural management, and sustainable farming from leading universities worldwide (e.g., University of California, Davis; University of Illinois). There's also the FAO e-learning Academy. The Food and Agriculture Organization of the UN offers a wide selection of free online courses on various aspects of agriculture, rural development, and food security. Their courses are oriented toward global challenges and local needs. To these, we should add Agri-Plattformen (Germany, Netherlands). National agricultural organizations and educational institutions create their own platforms to disseminate specialized knowledge, often integrating practical case studies and interactive tools.

2. Specialized Portals and Databases

Many countries create national and regional portals that accumulate scientific research, best practices, methodological guidelines, and legal acts in the agricultural sector. These resources are often used for knowledge exchange among scientists, practitioners, and educational institutions.

Examples of these resources include CAB International (CABI). This is an international non-profit organization that provides access to a huge database of scientific literature, manuals, and tools for agriculture and the environment. Another well-known resource is the USDA National Agricultural Library (USA). It is one of

the world's largest agricultural libraries, offering access to millions of resources, including digital collections, historical documents, and modern research.

3. Distance Learning Programs and Hybrid Models

Given the specifics of the agricultural sector, where the practical component is important, distance learning programs with elements of offline practical sessions are actively being implemented. This allows for a combination of the flexibility of online education with the necessary practical experience.

Examples of this resource include "Farm Business Management" (USA, Canada). Many universities and colleges offer online programs in farm management that include virtual tours, simulations, and the opportunity for consultations with experts. Agricultural colleges and technical schools can also be included here. They often develop their own distance courses for farmers who want to improve their qualifications without leaving production, with mandatory practical sessions at the educational institution or partner farms.

Video content creation and use is another type of resource. Visualization is a powerful tool for transferring knowledge in the agricultural sector. Video tutorials, demonstrations of new technologies, and interviews with successful farmers and agronomists are becoming increasingly popular educational resources.

Examples include YouTube channels of agricultural universities and research centers. Many institutions actively use YouTube to disseminate information, conduct webinars, and demonstrate practical skills. Specialized video platforms can also be actively used. Some countries develop their own platforms for video content focused on specific agricultural crops or technologies.

Another educational resource is integration with the real needs of agribusiness. The effectiveness of educational resources increases significantly when they are developed in close cooperation with agribusiness and farms. This ensures the relevance of the content and the correspondence of knowledge to the real needs of the labor market.

Examples of such a resource can be "farmer-to-farmer" programs. In some countries (particularly in Northern European countries), successful farmers share their

experience and knowledge with less experienced colleagues through special training seminars and consultations. Corporate training programs are also becoming widespread. Large agricultural holdings and companies develop their own educational programs and resources to improve the qualifications of their employees, often in cooperation with universities.

Despite significant achievements, international practices face a number of challenges, such as the digital divide, or insufficient access to the internet and digital devices in rural areas. The quality of content is also a problem, i.e., ensuring the high quality and relevance of educational materials. Another challenge is motivation to learn, or stimulating farmers to constantly update their knowledge. And finally, there is localization, or adapting international experience to local climatic, economic, and social conditions.

However, the prospects for the development of educational resources in the agricultural sector are significant. Further integration of the latest technologies (artificial intelligence, virtual and augmented reality), expansion of international cooperation, and creation of programs adapted to regional needs will make it possible to train highly qualified specialists capable of solving the modern challenges of agriculture.

Ukrainian agrarian higher education institutions (HEIs) play a key role in training personnel for agriculture and developing agricultural science. In the context of dynamic changes in the industry, integration into the global educational space, and the challenges associated with the full-scale invasion, the formation of high-quality and accessible educational resources becomes one of the priority tasks. The experience of Ukrainian agrarian HEIs in this area is multifaceted and constantly evolving, so its main stages can be cited.

I've translated the text about the experience of Ukrainian agrarian higher education institutions.

1. Transition to Digital Educational Resources. A significant number of Ukrainian agrarian HEIs are actively implementing digital technologies in the educational process. This is driven by global trends and the need to ensure educational

continuity during the COVID-19 pandemic and the full-scale invasion. Distance Learning Systems (LMS): The vast majority of agrarian HEIs use platforms like Moodle, Google Classroom, or their own developments to host learning materials, conduct online lectures, seminars, and knowledge assessments. This allows students to access resources at their convenience from anywhere. Electronic Libraries and Repositories: Creating electronic libraries with access to textbooks, study guides, monographs, scientific articles, and periodicals is an integral part of the educational process. Some HEIs are establishing their own institutional repositories to store the research of instructors and students, conference materials, etc. Video Lectures and Webinars: Video lectures are actively recorded, and webinars are held with industry experts. This helps visualize the material and allows for the participation of specialists without requiring their physical presence.

2. Creation of In-House Learning and Methodological Materials. Ukrainian agrarian HEIs traditionally place great importance on developing their own learning and methodological materials that consider the specifics of Ukrainian agricultural production and the achievements of domestic science. Textbooks and Guides: Instructors actively create textbooks and study guides that reflect the current state of agrarian science, advanced technologies, and domestic experience. The number of electronic versions of these publications has been growing recently. Practical and Laboratory Work: Detailed methodological guidelines for conducting laboratory and practical work are being developed, often accompanied by video instructions and virtual simulators where possible. Case Studies and Situational Assignments: To develop analytical and decision-making skills, HEIs are implementing case studies based on real production situations in agribusiness.

3. Cooperation with Agribusiness and International Partners. To ensure the relevance of educational resources and their alignment with labor market needs, agrarian HEIs are actively cooperating with agribusiness representatives and international organizations. Involving Practitioners: Practitioners are involved in developing curricula and giving lectures, which allows for the integration of real-world production experience into the educational process. Joint Projects: Joint research and

educational programs are implemented with agricultural companies, giving students the opportunity to work on real tasks and gain practical skills. International Grants and Programs: Participation in international grant programs (like Erasmus+ and Horizon Europe) promotes the exchange of experience, access to the latest educational methods and resources, and the development of joint courses.

4. Challenges and Directions for Development. Ukrainian agrarian HEIs face a number of challenges in forming educational resources. Material and Technical Base: There is a need to modernize the material and technical base, especially laboratory equipment, to create more interactive and technological educational resources. Instructors' Digital Competence: There is a need for continuous improvement of instructors' digital competence for the effective use and creation of modern digital educational resources. Content Relevance: The rapid pace of development of agrarian technologies requires constant updating of the content of educational programs and resources. Accessibility in Wartime: It's crucial to ensure unimpeded access to educational resources for students who are in different regions of Ukraine and abroad, as well as to protect digital infrastructure.

The prospects for development include. Implementation of Interactive Simulators and Virtual Laboratories: This will allow students to gain practical skills in a safe and controlled environment. Development of MOOCs and Short-Term Online Courses: This is for improving the qualifications of working professionals and popularizing agrarian professions. Use of Artificial Intelligence: This can be used for personalizing education, analyzing educational trajectories, and creating adaptive learning materials. Deepening Cooperation with Business: This involves creating joint research centers and innovation hubs for the rapid transfer of technologies and the formation of in-demand educational resources.

3.2 The Impact of Crisis Situations on the Functioning and Development of Agrarian Heis

Higher education institutions are complex socioeconomic systems that are closely intertwined with their external environment. This interdependence makes them vulnerable to various crises, which can significantly affect all aspects of their activities—from the educational process and scientific research to financial stability and reputation. Understanding the types of crises and their characteristics is key to developing effective anti-crisis management strategies.

Crises that affect the functioning of HEIs can be classified by their nature and source of origin. Economic Crises: These are related to financial instability, a lack of resources, or changes in economic policy that directly impact the HEI. Reduced state funding: A decrease in budget allocations for education leads to a lack of funds for salaries, updating the material and technical base, scientific research, and social programs. Inflation and rising prices: The devaluation of the national currency and an increase in the cost of energy, utilities, equipment, and learning materials raise the HEI's operating costs. Decreased ability of applicants/students to pay: The population's economic difficulties can lead to a decrease in the number of contract-based students, which reduces extra-budgetary income. Labor market crisis: A mismatch between educational programs and the needs of the labor market can lead to a low level of graduate employment, which negatively affects the HEI's reputation and the demand for its specialties. Social Crises: These relate to internal or external social conflicts, changes in the demographic situation, societal values, or problems in relationships with stakeholders. Demographic crisis: A decrease in the number of high school graduates leads to a reduction in the potential pool of applicants, especially in regions with low birth rates or high migration. Internal conflicts: Disputes between the administration and instructors/students (for example, regarding learning conditions, corruption, or rights violations) can lead to strikes, protests, or significant staff turnover. Crisis of trust and reputation: Public scandals, accusations of corruption, plagiarism, low quality of education, or unethical behavior can cause irreparable damage to the HEI's image.

Changes in social priorities: A decrease in the prestige of higher education in general or of specific specialties can affect the HEI's attractiveness. Technological Crises: These crises arise from accidents or breakdowns of technical systems or infrastructure used by the HEI. Accidents in communications: Damage to water supply, heating, or electrical systems disrupts the functioning of academic buildings and dormitories. Failures in information systems: Cyberattacks, hacking, server breakdowns, or data loss can make it impossible to access electronic resources, distance learning systems, or administrative databases. Equipment breakdowns: The failure of critically important laboratory, computer, or specialized educational equipment interrupts the educational and scientific processes. Fires or building destruction: Technological accidents that lead to the partial or complete destruction of the HEI's infrastructure. Natural Crises: This type of crisis is caused by natural disasters or unfavorable natural phenomena. Floods, earthquakes, hurricanes: Natural disasters that can damage buildings and infrastructure and require the interruption of the educational process and the evacuation of students/staff. Epidemics/pandemics: Widespread diseases (such as COVID-19) that require a transition to distance learning, limit access to campus, and affect the physical and psychological health of those involved in the educational process. Long periods of abnormal heat/cold can make staying in classrooms difficult and require a change in work schedules or the temporary suspension of classes. Military Crises: These are exceptionally destructive crises resulting from armed conflicts, hostilities, and occupation. This is the most complex type of crisis Ukraine has faced since 2014, with a dramatic escalation since February 2022. Infrastructure Destruction: Direct damage to academic buildings, dormitories, laboratories, and libraries from shelling, bombings, and other combat actions. Displacement of Staff and Students: Mass migration of the population and the evacuation of HEIs or their branches, leading to a loss of personnel and students. Safety Threats: The need to organize shelters and conduct classes in bomb shelters, posing a risk to the life and health of everyone in the educational process. Economic Losses and Financial Difficulties: Reduced HEI income, loss of assets, funding problems, and the redistribution of budget funds for defense needs. Disruption of the Educational Process: The inability to hold in-person classes, power outages, and

internet disruptions, which require a rapid transition to distance learning and the adaptation of educational programs. Psychological Impact: The severe psychological state of instructors and students, including post-traumatic stress disorder, which requires psychological support and an adaptation of teaching methods. Political and Legal Crises. These crises are related to changes in government, legislation, or political conflicts that affect the autonomy and functioning of HEIs. Radical Legislative Changes: New laws that restrict HEI autonomy or change the rules for funding, licensing, or accreditation. Change of Government or Leadership: A shift in political priorities can lead to a review of state policy in education, affecting HEIs. Political Pressure: Attempts at political interference in HEI activities, the appointment of leaders based on political motives, and the limitation of academic freedoms.

Each of these crises has unique sources, dynamics, and consequences. For Ukrainian HEIs, the challenge is that multiple factors often combine, especially during a full-scale war, which acts as a catalyst and compounding factor for all other types of crises. Effective crisis management requires continuous monitoring of the external environment, developing preventive measures, planning for emergencies, and having the ability to quickly adapt and resume functioning.

Crisis situations, regardless of their nature—economic, social, technological, natural, or military—have a deep and multifaceted impact on the functioning of HEIs. This impact is specific because it affects not only the material and technical base or finances but also the core aspects of an HEI's mission: the educational process, scientific activity, social role, and, of course, management effectiveness.

The educational process is at the heart of an HEI's activities, and it's often the first thing to suffer during a crisis. Let's break down the impact of each type of crisis on the educational process.

1. Disruption and Changes to Learning Formats Crises can force a sudden shift in how education is delivered. Natural and technological disasters can lead to temporary closures, evacuations, and damage to classrooms and laboratories, making in-person classes impossible. Epidemics and pandemics demand an immediate transition to distance learning, requiring rapid adaptation from instructors and students

and access to technology and resources. Military actions are the most destructive factor. In a war (as is happening in Ukraine), the educational process can be completely interrupted, HEIs may be destroyed, and students and instructors may be forced to relocate. Even when distance learning is maintained, air raid sirens, power outages, internet disruptions, and psychological stress make learning significantly more difficult.

2. Decrease in the Quality and Effectiveness of Learning. The quality of education can be negatively affected by several factors during a crisis. Lack of resources: Economic crises often lead to reduced funding, affecting the purchase of new equipment, the updating of library collections, and access to modern digital resources. This limits the ability to effectively train specialists. The psychological state of participants: The stress, anxiety, and uncertainty associated with a crisis (especially war) reduce the concentration of students and instructors and affect their motivation and ability to learn new material. Limitation of practical training: Crises, especially technological and military ones, can make it impossible to conduct laboratory work, field practices, and internships, which are critically important for many specialties, particularly in agriculture.

3. Changes in Educational Content. Crises directly influence the content of educational programs and how they are delivered. Program adaptation: In a crisis, HEIs may be forced to quickly adapt their curricula to account for new realities (for example, by including modules on crisis management, cybersecurity, and pre-medical aid during wartime). Focus on resilience: There is a growing need to develop students' skills in resilience, adaptability, critical thinking, and problem-solving in difficult conditions.

Crisis situations require HEI administration to make quick, flexible, and strategically sound decisions, which significantly changes traditional management approaches.

4. Financial Instability. Financial instability can be a major challenge. Budget constraints: Economic crises lead to the need for strict austerity measures, budget reviews, cost optimization, and the search for alternative funding sources (grants,

international aid, and private revenue). Risk management: There is a need to develop financial "safety nets" and diversify sources of income to ensure sustainability.

5. Human Resources Challenges. Crises can cause significant staffing issues within an HEI. Staff Turnover: During economic or military crises, HEIs may lose qualified instructors and administrative staff due to migration, mobilization, or the search for better employment opportunities. Retraining and Professional Development: There is a pressing need for instructors to quickly learn how to use new technologies for distance learning and to develop skills in providing psychological support to students. Mobilization: In wartime, a portion of the male faculty and student body may be mobilized into the armed forces, creating a significant staffing shortage.

6. Infrastructure and Logistics Problems. A crisis directly impacts the physical and technical operations of an HEI. Ensuring Safety: During military crises, this means creating and equipping shelters, developing evacuation plans, and ensuring security measures on campus. Restoration and Modernization: After destruction, enormous costs are required to restore buildings, repair damaged infrastructure, and purchase new equipment. Ensuring Uninterrupted Operation: It is essential to solve problems with electricity, communications, and heating, especially during attacks on the energy infrastructure.

7. Changes in Management Culture. Crises demand a new, more adaptive approach to management. Increased Flexibility and Adaptability: HEI leadership must react quickly to changes, make decisions in uncertain conditions, and constantly adapt their strategies. Decentralization of Decisions: Delegating authority and responsibility to lower levels of management can speed up the response to local problems. Communication and Transparency: Effective and open communication with all stakeholders (students, instructors, parents, the Ministry, and partners) is critically important to maintain trust and minimize panic. Psychological Support for Staff: HEI management must provide psychological support for their employees who are under chronic stress.

8. Reputational Risks. Ultimately, poor crisis management can lead to the loss of an HEI's reputation, a decrease in the number of applicants, and a decline in trust from partners.

The impact of crises on HEIs is all-encompassing, transforming both the educational process and management mechanisms. In such dynamic and often unpredictable circumstances, as those experienced by Ukraine, an HEI's effectiveness depends on its ability to demonstrate resilience, adaptability, an innovative approach, and proactive anti-crisis management. This requires not only quick tactical decisions but also strategic planning aimed at increasing internal flexibility and strengthening partnerships to ensure the continuity and quality of education in any circumstances.

Agrarian education in Ukraine, as in many other countries, has its own unique specifics that determine how crisis situations affect it. Unlike, for example, IT education, which focuses on digital technologies and remote work, the agricultural sector is deeply integrated into the natural environment, depends on seasonality, has a significant material and technical base, and is closely linked to real production. This makes agrarian higher education institutions (HEIs) vulnerable to crises that may have a different character compared to general education.

Agrarian education trains specialists for a sector that directly depends on natural conditions. This creates unique challenges. Impact on Practical Training: Droughts, floods, frosts, or other abnormal weather events can destroy crops on educational and research fields, making it impossible to conduct field practices and internships. This is critical for students in agronomic, veterinary, and engineering-technical specialties, where direct contact with production is fundamental. Scientific Research: Natural disasters can nullify years-long experiments and research projects conducted at the HEI's research stations. Changes in Curricula: Climate change requires constant adaptation of educational programs to include new disciplines on adapting agriculture to climate change, sustainable land use, and water resource management.

Agrarian HEIs have large laboratory complexes, educational farms, and machine and tractor fleets that require significant investment for maintenance and updating. This leads to certain problems. High Maintenance Costs: Economic crises or reduced

funding have a particularly painful impact on agrarian HEIs, as maintaining laboratories, machinery, and livestock complexes is very expensive. Risks of Destruction: Technological accidents or military actions (as is happening in Ukraine) can cause irreparable damage to unique and expensive equipment, agricultural machinery, greenhouses, and livestock farms, which are the basis for the practical training of specialists. Restoring such infrastructure requires colossal funds and time. Equipment Obsolescence: The rapid development of agricultural technologies (precision farming, drones, sensors) requires constant updating of machinery and laboratory equipment, which is difficult to ensure during a crisis.

Agrarian education must be as closely aligned as possible with the needs of production. Crises also affect this connection, causing. Changes in the Labor Market: Economic crises or war can lead to changes in the structure of agribusiness (the disappearance of some enterprises, re-profiling, relocation), which requires the rapid adaptation of educational programs and specialties. Employment Problems: Crises can reduce the demand for specialists and complicate internships and graduate employment. Problems in Cooperation with Business: Companies in the agricultural sector may reduce investments in partnership programs with HEIs, scientific research, or sponsorship, which limits opportunities for development. Loss of Access to Enterprises: In conditions of military action or occupation, HEIs may lose access to partner farms and enterprises for practical training, which is critical for hands-on experience.

Many students at agrarian higher education institutions (HEIs) come from rural areas or regions where agriculture is the main activity. This leads to common challenges like. The digital divide: In rural areas, access to high-speed internet and modern digital devices can be limited, which complicates the transition to distance learning during a crisis. Migration processes: War or economic problems can cause mass migration from rural areas, leading to a decrease in the number of applicants and students in agrarian specialties. Regional specificity: Each agrarian HEI often has its own regional specialization (e.g., animal husbandry, crop production, viticulture). A crisis that affects a specific industry can have a devastating impact on that HEI.

For Ukraine, the military crisis is the most dominant and destructive factor, exacerbating all other issues and causing. Physical destruction: Agrarian HEIs, like other infrastructure, can be destroyed as a result of hostilities. An example is the destruction of academic buildings or educational and research farms. Loss of territories: The occupation of territories leads to the loss of control over HEI branches and educational and research farms, as well as the loss of access to major agro-industrial regions that were a base for practical training. Security risks: The constant threat of missile attacks, drones, and shelling requires organizing classes in bomb shelters, which is psychologically difficult and not conducive to a quality educational process. Mobilization of students and instructors (especially male) creates a significant personnel shortage and disrupts the continuity of the educational process.

The specific challenges of crisis situations in the context of agrarian education are due to its close connection with nature, production, a significant material and technical base, and regional specificity. The successful functioning of agrarian HEIs during crises requires developing flexible strategies, investing in digitalization and practical training, strengthening cooperation with agribusiness and international partners, and creating a systemic support for recovery and development in the face of long-term challenges, particularly war.

The agro-industrial complex (AIC) of Ukraine, like the global agricultural sector, is undergoing a period of rapid transformation driven by technological progress, global challenges (climate change, food security), and the unique circumstances caused by the full-scale invasion. These changes directly impact the needs of the labor market, requiring new competencies and flexibility from AIC specialists.

The Dominant Role of Technology and Digitalization (AgriTech). Perhaps the most significant change is that modern agriculture is no longer just a sector based on physical labor; it is becoming a high-tech field. Therefore, the most in-demand agricultural professions are now. Precision farming specialists: There is a growing demand for agronomists who know how to work with GPS navigation, drones, sensors, crop and soil monitoring systems, and data analysis software. This requires knowledge of Geographic Information Systems (GIS), Remote Sensing (RS), and analytics.

Cybernetics and Robotics Engineers: There is a need for specialists who can maintain, program, and develop autonomous agricultural machinery, as well as robotic systems for harvesting, animal feeding, and monitoring livestock health. Big Data and Artificial Intelligence (AI) Specialists: The agro-industrial complex generates vast amounts of data (on yields, weather, soil, and prices). Analysts are needed who can interpret this data to optimize production, forecast markets, and manage risks. Internet of Things (IoT) Specialists in the AIC: The development of "smart farms," where every element (from soil moisture sensors to livestock ventilation systems) is connected to a network, requires engineers and technicians capable of installing, configuring, and maintaining these systems.

The increasing attention to environmental problems and the sustainable use of resources is also changing the requirements for specialists. The most common professions now are. Agro-ecologists: There's a growing demand for specialists who understand organic farming, resource-saving technologies, biological plant protection, and minimizing environmental impact. Water Resource Management Specialists: In the context of climate change and more frequent droughts, there is a growing need for specialists in the efficient use and conservation of water resources and irrigation systems. Certification and Standardization: Knowledge of international product quality and safety standards (GlobalGAP, organic certification) is becoming mandatory for many positions.

Modern agribusiness requires not only technical skills but also strong management and economic competencies. The demand for management specialists is increasing. Agri-managers: There is a need for specialists who can effectively manage large agricultural holdings, optimize business processes, and handle financial planning, marketing, and logistics. Risk Management Specialists: In conditions of instability (weather, prices, geopolitics), there is a growing demand for specialists who can forecast risks and develop strategies to minimize them. AIC Economic Analysts: These professionals must be able to conduct in-depth economic analysis, create business plans, and evaluate the effectiveness of investments. Agrarian Law Specialists: Given

changes in land legislation and international trade, there is a growing need for legal experts who specialize in agrarian law.

The boundaries between specialties are blurring, and a modern AIC specialist must be versatile and possess. Communication Skills: The ability to effectively interact with various stakeholders (partners, investors, workers). Critical Thinking and Problem-Solving: The ability to analyze complex situations and find creative solutions in uncertain conditions. Adaptability and Flexibility: The readiness to learn quickly and retrain in response to changes in technology and the market. Leadership and Teamwork: The ability to organize and motivate teams and work effectively in multidisciplinary groups. Foreign Languages: Knowledge of English is becoming almost mandatory for accessing international information, technologies, and collaboration.

The full-scale invasion has significantly changed labor market needs, adding new dimensions such as. Safety Aspects: A need for specialists who can work in conditions of mine danger and ensure the safety of equipment and personnel. Reconstruction and Recovery: There is a growing demand for engineers, builders, and agronomists capable of restoring destroyed infrastructure, demining land, and implementing technologies to quickly restart production. Logistics and Export: Changes in logistics routes and challenges in exporting agricultural products increase the need for specialists in international logistics, customs clearance, and international law. Psychological Resilience: For work during the war and post-war recovery, psychological resilience and the ability to work under stress are critically important. Increased Demand for Skilled Labor: Due to mobilization and migration, there is a shortage of skilled workers (tractor drivers, combine operators, machine operators), which requires rapid training programs.

The labor market of the agro-industrial complex is evolving from traditional agricultural skills to integrated competencies that combine agricultural knowledge with high technology, analytical abilities, environmental awareness, and management skills. Ukrainian agrarian HEIs must actively adapt their educational programs, implement dual education, and strengthen cooperation with business to produce specialists who

meet these new, dynamic requirements. The success of the Ukrainian AIC in the post-war period will largely depend on the education system's ability to respond quickly and effectively to these changes.

Adapting educational programs is one of the most important tasks for higher education institutions (HEIs) in today's rapidly changing world. This is especially relevant for Ukraine, which is influenced by global technological trends and is experiencing unique challenges related to the full-scale war. Effective adaptation of educational programs allows HEIs to remain relevant, train competitive specialists, and contribute to the country's recovery and development.

Why is adaptation critically important? First of all, it impacts. Relevance to the Labor Market: New technologies, economic changes, and social transformations constantly change the requirements for professional competencies. Programs must prepare graduates for the real needs of employers. Graduate competitiveness: Only relevant knowledge and skills allow graduates to be in demand in both the domestic and international labor markets. Ensuring the quality of education: Adapted programs reflect the modern state of science and practice, which increases the quality of learning. HEI sustainability: HEIs that adapt quickly are better able to survive crises and remain attractive to applicants. National reconstruction: In the context of Ukraine's post-war reconstruction, educational programs must meet the country's strategic needs for restoring and developing key sectors. Main Directions for Adapting Educational Programs.

1. Integrating the Latest Technologies and Digitalization. Implementing AgriTech: For agrarian education, this means including modules on precision farming, the use of drones, GIS technologies, sensors, Big Data, and artificial intelligence in agronomy, veterinary medicine, and engineering. Digital Literacy: Developing digital competencies in students across all specialties. This includes working with cloud services, online collaboration tools, and the basics of cybersecurity. Virtual and Augmented Reality (VR/AR): Developing simulators and virtual laboratories for practical training, especially where access to real equipment is limited or dangerous (e.g., in a combat zone).

2. Strengthening the Practical Component and Dual Education. Cooperation with Business: Close interaction with leading companies in the industry to jointly develop programs, conduct guest lectures, and organize internships and practical training. Dual Education: Expanding programs where theoretical training at the HEI is combined with practical work at enterprises. This allows students to gain relevant skills and adapt to the realities of production while still studying. Case Studies and Project-Based Learning: Actively using real business cases and involving students in working on specific projects for enterprises.

3. Developing Soft Skills and Universal Competencies. Critical Thinking and Problem-Solving: Teaching how to analyze complex situations, formulate hypotheses, and find effective solutions. Communication and Teamwork: Developing skills for effective interaction, presentation, and working in multidisciplinary teams. Adaptability and Flexibility: Preparing for continuous learning and retraining throughout life and the ability to adapt quickly to change. Emotional Intelligence and Stress Resistance: These skills are especially important during crises, as they allow for effective functioning under pressure and overcoming difficulties.

4. Focusing on Sustainable Development and Environmental Awareness. Green Competencies: Including the principles of sustainable development, the circular economy, ecological farming, and energy efficiency in programs. Responsible Consumption and Production: Fostering an understanding of the impact of professional activities on the environment and the social sphere.

5. Adaptation to Wartime and Post-War Reconstruction. Security Aspects: Inclusion of modules on first aid, civil defense, and mine safety. Reconstruction and Recovery: Development of specialized modules or programs on infrastructure reconstruction, demining, psychological rehabilitation, and managing recovery projects. Format Flexibility: Ensuring the possibility of learning in various formats (in-person, distance, hybrid), the option to transfer credits from other HEIs (national and international), and the adaptation of class schedules. Psychological Support: Integration of psychological support elements for students and instructors into the educational process.

Mechanisms and Challenges of Adaptation. Labor Market Monitoring: Constant analysis of employer needs, cooperation with employment centers and HR agencies. International Experience: Studying and implementing the best global practices in educational program development. Instructor Professional Development: Systematic training of educators in new technologies, methods, and content. Regulatory Flexibility: The ability of regulatory bodies (the Ministry of Education and Science) to quickly adapt educational standards to new realities. Funding: The need for significant investment in modernizing the material and technical base and developing innovative educational resources.

The adaptation of educational programs is a continuous process that requires constant interaction between HEIs and all stakeholders: students, employers, government bodies, and international partners. This is the only way Ukrainian education can effectively respond to modern challenges and prepare a new generation of specialists for the country's successful future.

Traditional educational resources and infrastructure are the fundamental elements of the educational process. They include physical buildings (classrooms, laboratories, libraries, dormitories), printed learning materials (textbooks, manuals), and equipment (specialized devices, machinery). Access to these resources is critically important for quality education, but in the face of modern challenges, especially in Ukraine, it is encountering a number of serious problems.

1. Physical Inaccessibility and Infrastructure Destruction.

This is one of the most acute problems, particularly in wartime Ukraine. It includes: Direct Destruction: Military actions lead to the complete or partial destruction of academic buildings, laboratories, libraries, and dormitories. This makes it impossible to hold in-person classes and use specialized equipment. The destroyed infrastructure requires immense funds and time to restore. Occupation of Territories: The occupation of territories leads to the loss of control over HEIs and their material base. Some equipment may be removed or damaged.

2. Obsolete and Worn-Out Material and Technical Base.

Even undamaged infrastructure is often in a poor state of repair. Physical Deterioration: Many buildings, furniture, and educational tools are physically and technologically outdated. A significant portion of library collections may also be outdated. Technological Mismatch: This is especially critical in agrarian education, where the rapid development of AgriTech requires constant modernization of machinery, tractor fleets, and laboratory equipment (e.g., for precision farming and biotechnology). Outdated equipment prevents students from learning with modern tools. Lack of Investment: Years of limited funding for education have compounded these issues and left HEIs without the funds for systematic modernization.

3. Economic Limitations and Lack of Funding.

Economic crises and the war create significant obstacles for maintaining and developing traditional resources. Insufficient State Funding: Budgetary constraints prevent HEIs from properly maintaining existing infrastructure, let alone updating it. During the war, the prioritization of military spending further exacerbates this problem. High Operating Costs: Maintaining large campuses, labs, and dormitories requires significant funds for utilities, repairs, and equipment maintenance, which is a burden for HEIs, especially with reduced revenue. Logistical and Supply Problems: War makes it difficult or impossible to supply new equipment, reagents, and spare parts, making it hard or impossible to repair existing equipment.

4. Limited Access to Printed Resources.

Despite the growth of digital libraries, printed materials remain a vital component of education. However, students don't always have access to them due to a number of problems. Physical Accessibility: Library collections may be destroyed or damaged, and students may be unable to physically visit libraries due to security threats or displacement. Outdated Materials: The high cost of publishing new textbooks and manuals that reflect the latest scientific advances and legal changes leads to the use of outdated publications. Insufficient Copies: There's a shortage of textbooks and manuals for all students, especially for specialized subjects.

5. Social and Demographic Challenges.

The war has caused significant social and demographic shifts that impact access to traditional educational resources. Internally Displaced Persons (IDPs): Students and instructors who are IDPs often lose access to their usual resources and must adapt to new environments that may not provide full access to the necessary infrastructure. Decreased Enrollment: Demographic problems and migration have reduced the number of students, which can lead to the suboptimal use of existing but underutilized infrastructure.

The problems of access to traditional educational resources and infrastructure in Ukraine are multifaceted and require complex solutions. These include not only financial investment for restoration and modernization but also the development of new models for using available infrastructure, strengthening international cooperation to receive aid, and integrating traditional resources with modern digital technologies. Ensuring the physical safety and functionality of the learning environment is a basic condition for the restoration and development of quality Ukrainian education.

Digitalization and distance learning have become not just an alternative to traditional education but an integral part of it, especially in the context of global challenges like the COVID-19 pandemic and the full-scale war in Ukraine. Their potential for ensuring the continuity, accessibility, and modernization of the educational process is enormous and continues to unfold. The advantages of these learning methods are as follows:

1. Accessibility and Inclusivity. Geographic Independence: Digital technologies break down geographical barriers, allowing students to get an education from leading HEIs and instructors from anywhere in the world with internet access. This is especially relevant for Ukraine, where a significant portion of the population has been forced to relocate within the country or abroad. Distance learning allows them to continue their education while far from their hometown. Flexible Schedules: Students can learn at their own pace, choosing a convenient time to study materials, watch lectures, and complete assignments. This makes it possible to combine studies with work, family responsibilities, or other activities, significantly expanding the circle of potential students (e.g., for working professionals or people with disabilities). Inclusivity:

Distance learning opens up wider opportunities for people with special educational needs or physical limitations who may have difficulty attending traditional classrooms.

2. Personalization and Adaptability of Learning. Adaptive Learning Paths: Thanks to data analysis (Big Data) and the use of artificial intelligence (AI), digital platforms can offer individual learning paths, adapting content, task difficulty, and learning pace to the needs and knowledge level of each student. Instant Feedback: Automated testing systems and interactive assignments allow students to receive immediate feedback, which promotes better material retention and timely knowledge correction. Content Selection: Students have access to a wide range of educational resources (video lectures, interactive simulations, electronic textbooks, online libraries), allowing them to choose the most effective learning formats for themselves.

3. Enrichment of Educational Content and Interactivity:

Digital resources offer a richer, more engaging learning experience than traditional methods. Multimedia: Digital tools integrate videos, audio, animations, interactive graphics, and 3D models, making learning material more visual, interesting, and easier to understand. Virtual Laboratories and Simulators: These are especially valuable for agrarian education, where direct access to real equipment may be limited. Virtual labs allow students to conduct experiments, simulate working with complex machinery, and practice hands-on skills in a safe and controlled environment. Gamification: Integrating game elements can increase student engagement and motivation to learn. International Collaboration: Online platforms facilitate joint projects, webinars, and lectures with international experts, broadening the horizons of students and instructors.

4. Efficiency in Management and Administration

Digitalization streamlines administrative and managerial tasks, making them more efficient. Process Automation: Digital platforms automate routine administrative processes such as registration, scheduling, academic record keeping, and issuing certificates. Centralized Data Storage: All learning materials, assignments, grades, and student data are stored in a single system, simplifying access and management. Learning Analytics: Distance learning systems collect a large amount of data on student

progress, activity, and problem areas. This allows instructors and administrators to analyze the effectiveness of programs and make timely adjustments.

5. Sustainability and Continuity of Education in Crisis Conditions:

Digitalization provides a robust solution for maintaining education during crises. Emergency Response: As shown by the pandemic and the war in Ukraine, digitalization and distance learning allow for rapid adaptation to changing circumstances, ensuring the continuity of the educational process even when physical attendance at an HEI is impossible. Support for Displaced Persons: For internally displaced persons and refugees, online education is the only way to continue their studies or gain new professional competencies.

Despite their significant potential, fully realizing the benefits of digitalization and distance learning requires addressing several challenges. Digital Divide: Access to the internet and equipment is insufficient in some regions and for certain population groups. Quality and Relevance of Content: There is a constant need to create high-quality, up-to-date, and interactive digital content. Instructor Qualifications: Instructors need continuous training to improve their digital competence and learn new methods of online teaching. Cybersecurity: Protecting data and systems from cyberattacks is crucial to maintaining a secure learning environment. Psychological Aspect: Providing psychological support for students and instructors and preventing "burnout" from excessive online interaction are critical for well-being. Balancing Online and Offline: Finding the optimal balance between distance and in-person learning is essential, especially for practical-oriented specialties like those in agriculture.

The potential of digitalization and distance learning for Ukrainian education is enormous. They are not just tools for survival in a crisis but a strategic direction for modernization, increasing competitiveness, and ensuring quality and accessible education for future generations.

In a world characterized by rapid change and unpredictable crises, the flexibility and adaptability of educational resources are not just desirable qualities but essential conditions for the effective functioning of higher education institutions (HEIs) and the provision of quality education. This is especially relevant for Ukraine, where the

ongoing war requires an immediate response to constantly changing circumstances. Here's why flexibility and adaptability are critically important?

1. Responding to Crises and Emergencies. Continuity of Learning: The ability to quickly switch between different learning formats (in-person, distance, hybrid) in response to security threats (air raids, shelling), power outages, or infrastructure destruction is vital. Flexible resources allow the educational process to continue, minimizing losses. Support for Displaced Persons: The ability to adapt educational materials and access for students and instructors forced to change their place of residence or who are abroad is a key benefit.

2. Meeting the Demands of a Dynamic Labor Market. Rapid Content Updates: Technology and labor market requirements are changing so fast that educational programs and resources must be continuously updated. Flexibility allows for quick changes to curricula, adding new modules and courses to reflect the latest trends. Developing In-Demand Competencies: Educational resources must be adaptable to develop not only hard skills (professional knowledge) but also soft skills (critical thinking, adaptability, communication), which are key to success in any field.

3. Personalization and Inclusivity of Learning. Individualized Learning Paths: Flexible resources allow students to choose individual learning paths, adapting the pace, format, and content to their needs, prior knowledge, and goals. Diverse Learning Styles: The availability of various resource formats (video, interactive simulations, text, audio) meets the needs of students with different information absorption styles. Inclusive Design: Adaptive resources can be designed to accommodate the needs of students with special educational needs (for example, with the ability to change fonts, add voiceovers, or provide subtitles).

4. Effective Use of Resources and Cost Optimization. Modularity: Creating educational resources as independent modules that can be easily combined, rearranged, and integrated into different courses or programs allows for a more rational use of content that has already been created. Open Educational Resources (OER): Using and creating open resources that can be freely distributed, modified, and adapted reduces the cost of developing and accessing materials.

Where Do You See Evidence of Flexibility and Adaptability? Multiformat Content: The availability of materials in different formats (text, video, podcasts, interactive simulations, 3D models) allows students to choose the most convenient way to absorb information. Modularity and Microlearning: Breaking down large courses into small, self-contained modules that can be studied separately or combined into other educational programs. This also includes the development of short-term courses and micro-qualifications. Distance and Hybrid Models: The ability to easily switch between in-person, distance, and hybrid learning formats ensures access to resources regardless of physical location. Technological Neutrality: Resources are designed to be used on different devices (computers, tablets, smartphones) and operating systems. Rapid Updates: Built-in mechanisms for quickly updating content, making changes, corrections, and additions in response to new scientific discoveries, legislative changes, or technologies. Collaboration and Co-creation: Involving instructors, students, experts, and business representatives in the joint development and updating of educational resources.

Flexibility and adaptability of educational resources are not just a response to crisis challenges but a strategic path for the development of Ukrainian education. Implementing these principles will allow HEIs to function more effectively in conditions of uncertainty, prepare specialists with relevant knowledge and soft skills, and contribute to Ukraine's integration into the global educational space. This requires investment in digital infrastructure, professional development for educators, and changes in management culture, but these efforts are the key to the stability and successful future of Ukrainian education.

In the modern educational landscape, which is rapidly transforming under the influence of technological progress and global challenges, the role of digital and interactive educational resources is growing dramatically. Education is moving from passive consumption of information to active interaction, personalization, and engagement, which has become possible due to the development of information and communication technologies. This is especially noticeable in Ukraine, where the events of recent years have accelerated the digital transformation of education.

The role of digital and interactive educational resources is growing due to several key factors that have radically changed the landscape of modern education.

These factors include. Technological Progress: The widespread availability of high-speed internet, powerful computers, smartphones, and tablets, along with the development of AI and VR/AR, has made digital resources both accessible and highly functional. Generational Change: Modern students (Generation Z and Alpha) are "digital natives" who have grown up with technology. They expect the educational process to be dynamic, interactive, and aligned with their style of information perception. Global Challenges and Crises: The COVID-19 pandemic demonstrated the critical importance of digital resources for ensuring learning continuity. The war in Ukraine has cemented distance learning as a necessary part of education, and digital resources have become the only way millions of students can access knowledge. Economic Feasibility: In the long term, creating and distributing digital resources can be more cost-effective than constantly re-printing physical materials or maintaining large physical libraries. Accessibility and Inclusivity: Digital resources remove geographical barriers and create learning opportunities for people with disabilities, residents of remote areas, and those who cannot physically attend an HEI.

The growing role of digital and interactive resources is an irreversible process. They offer unprecedented opportunities to improve the accessibility, quality, personalization, and effectiveness of learning. For Ukrainian education, which aims for recovery and integration into the global educational space, the active development and use of such resources are key strategic priorities. This will allow for the training of a new generation of specialists capable of operating in a constantly changing environment and using technology for innovative development.

In a rapidly changing world, especially during unprecedented challenges like the full-scale war in Ukraine, it is no longer enough for university graduates to possess only professional knowledge and skills ("hard skills"). New competencies, known as "soft skills" or "transversal competencies," are becoming increasingly important. These skills allow individuals to function effectively under conditions of uncertainty,

pressure, and transformation. Among them, resilience, stress resistance, and adaptability are particularly prominent. Let's characterize each of these competencies.

1. Resilience

Resilience is a person's ability to successfully overcome challenges, recover from setbacks, maintain functionality, and develop under stress, threats, or traumatic events. It's not just about enduring but also about becoming stronger after trials.

Why Resilience is Important for Graduates. Labor market uncertainty: Graduates face shifting professional requirements, frequent technological changes, and economic crises. Resilience allows them to not give up after initial setbacks in their job search or career growth but to seek new opportunities. Adapting to change: The modern world requires constant learning and retraining. Resilience helps graduates accept the need for these changes and actively adapt to them. Military realities: For Ukrainian graduates, resilience is a vital skill. It is the ability to continue learning or working under constant threats, losses, destruction, and psychological pressure.

How to Develop Resilience in HEIs. Project-based learning: Involve students in projects that require solving complex, unpredictable tasks where failures are possible and alternative solutions must be found. Decision-making under uncertainty: Model situations where students have to make decisions with limited information or under pressure. Self-regulation development: Offer training on managing emotions, setting goals, planning, and self-control. Psychological support: Provide access to psychologists and hold seminars on mental health and stress management techniques.

2. Stress Tolerance

Stress tolerance is the ability of a person's body and mind to function effectively under stress without allowing it to have a destructive impact on their activity and health. It enables them to maintain calmness, concentration, and productivity under pressure.

Why Stress Tolerance is Important for Graduates. Work intensity: Modern professions often involve multitasking, tight deadlines, and a high level of responsibility. Conflict situations: The ability to remain professional and effective in conflict-ridden or uncomfortable situations. Wartime context: For Ukrainians, stress

tolerance has become a fundamental skill. It is the ability to function during air raids, power outages, news of shelling, and the loss of loved ones.

How to Develop Stress Tolerance in HEIs. Workshops and simulation games: Create controlled situations that mimic stressful working environments. Time and workload management: Teach effective time and resource planning to prevent burnout. Relaxation and self-regulation techniques: Include elements of psychological relief, breathing techniques, and meditation or mindfulness practices in the educational process. Healthy routines: Promote a healthy lifestyle, physical activity, and sufficient sleep as a foundation for stress tolerance.

3. Adaptability

Adaptability is the ability to quickly and effectively adjust to new conditions and change one's behavior, approaches, and strategies according to the environment's demands. It is a proactive response to change.

Why Adaptability is Important for Graduates. Speed of technological change: New tools, programs, and methods are constantly appearing. Adaptability allows graduates to quickly master them and integrate them into their work. Changing professions: Some professions are disappearing, others are transforming, and new ones are emerging. Adaptability helps prepare graduates for retraining and a change in career path. International environment: Working in multicultural teams and interacting with people from different cultures requires adapting to new norms and values. Reconstruction of Ukraine: The future reconstruction will require specialists to quickly adapt to new projects, conditions, and technologies and to cooperate with international partners.

How to Develop Adaptability in HEIs. Cross-disciplinary learning: Integrate interdisciplinary courses and projects that require knowledge from various fields. Problem-based learning: Teach through solving real-world problems that have no single correct solution and require flexible thinking. Foreign language study: This broadens horizons and prepares graduates for interaction in a global environment. Critical thinking development: The ability to analyze information, question established approaches, and seek innovative solutions. Blended and distance learning: These

formats already force students and instructors to demonstrate adaptability to new learning conditions.

To effectively develop resilience, stress tolerance, and adaptability, HEIs must. Shift focus: Move from purely academic knowledge to the comprehensive development of a student's personality. Integrate into curricula: Include these competencies as learning goals in the descriptions of educational programs and individual disciplines. Teaching methods: Actively use interactive methods such as case studies, role-playing, debates, projects, and simulations. Instructor example: Educators who themselves demonstrate these qualities are the best example for students. Create a supportive environment: Foster a campus atmosphere of trust and mutual assistance, where students are not afraid to make mistakes and learn from them.

Developing these "flexible" competencies is key to the success of Ukrainian graduates in the post-war world. It will allow them not only to survive but also to actively participate in the recovery and development of the country, using their knowledge and ability to overcome any obstacles.

3.3 A Methodology for Designing Adaptive Educational Resources for Agrarian HEIs in Crisis Situations

Designing educational resources during a crisis requires a specific approach that accounts for unique challenges and limitations. When traditional learning formats are unavailable or unsafe, as is the case in Ukraine, educational resources must be not just informative but also highly effective, sustainable, and secure. This requires adhering to several key principles.

1. Systemic Approach

Educational resources shouldn't exist in isolation. They must form a cohesive, interconnected system that covers all components of the educational process—from learning materials to assessment—and supports various forms of learning.

Importance in a Crisis. Continuity: A systemic approach ensures a logical and sequential transition between topics and modules, even if learning is interrupted or

changes format. Comprehensiveness: Students receive a complete set of knowledge and skills rather than fragmented information, which is critical for preparing for professional work in uncertain conditions. Management: This approach simplifies administration and progress monitoring in a distance-learning environment.

Implementation: Use unified distance learning platforms (LMS, such as Moodle), integrate different resource types (videos, texts, tests, simulations) within a single course, and ensure a clear curriculum structure.

2. Interactivity

Educational resources should stimulate active engagement with the material, not just serve as a passive source of information. This fosters deeper learning, critical thinking, and practical skills.

Importance in a Crisis. Engagement: In distance learning or stressful conditions, interactivity helps maintain student attention, increase motivation, and reduce feelings of isolation. Risk-free practice: Virtual laboratories and simulators allow students to practice complex skills (e.g., operating machinery, diagnostics) in a safe environment. This is invaluable when access to real-world objects is limited or dangerous. Instant feedback: Allows students to immediately see and correct their mistakes, which accelerates learning.

Implementation: Embed tests and quizzes, use interactive exercises, virtual simulations, and incorporate opportunities for online discussions, collaborative projects, and gamification elements.

3. Multimedia

Using various types of media (text, images, audio, video, animation) to present information.

Importance in a Crisis. Clarity: Visualizing complex concepts and processes makes the material easier to understand and remember, especially for visual learners. Accessibility under various conditions: If watching a video isn't possible (due to slow internet or power outages), a student can listen to audio or read the text. This provides flexibility in content consumption. Emotional engagement: Quality multimedia content

can make learning more interesting and emotionally resonant, which is important during stressful times.

Implementation: Use video lectures, podcasts, animated diagrams, 3D models, photo galleries, and interactive presentations.

4. Accessibility

Educational resources must be accessible to all students, regardless of their physical condition, technical capabilities, location, or financial situation.

Importance in a Crisis. Inclusivity: Ensures access for students with special educational needs (e.g., subtitles for people with hearing impairments, text-to-speech for people with visual impairments). Technical Accessibility: Optimizes resources for low-speed internet, allows for offline downloading, and ensures compatibility with various devices (smartphones, tablets). Geographical Accessibility: Provides the ability to access materials from anywhere in the world. Free or reduced-cost access: In crisis conditions, it's crucial to ensure free or highly affordable access to key resources.

Implementation: Design resources with accessibility standards in mind (WCAG), optimize file sizes, use platforms that support offline mode, and create open educational resources (OER).

5. Security

This involves ensuring data protection, information confidentiality, and the physical safety of educational process participants while resources are being used.

Importance in a Crisis. Cybersecurity: Protecting platforms and data from hacking, information leaks, and DDoS attacks is especially important in the context of cyber warfare. Personal data protection: Adhering to GDPR standards and other regulations regarding the confidentiality of student and instructor information. Physical safety: In wartime, this means educational resources (e.g., apps or instructions) may contain recommendations on what to do during alarms, where to find shelters, and mine safety rules for those in risk areas. Platform Reliability: Choosing stable and secure educational platforms that can handle heavy loads and ensure uninterrupted access.

Implementation: Use secure protocols (HTTPS), two-factor authentication, regular software updates, data backups, and user training on cybersecurity best practices.

6. Relevance

The content of educational resources must be up-to-date with the latest scientific achievements, technological developments, and labor market demands.

Importance in a Crisis. Labor Market Relevance: Rapid changes in the economy and society require quick program adaptation so that graduates get the knowledge employers truly need. Information Reliability: In an information war and with the spread of fake news, educational resources must be a source of verified, scientifically-based information. Response to New Challenges: For example, in agrarian education, this involves including materials on agricultural recovery after demining, new logistics chains, and the use of drones in wartime and their potential in peacetime.

Implementation: Constantly monitor scientific publications and industry trends, collaborate closely with employers and leading experts, regularly update content, and use a modular principle that allows for easy addition or replacement of individual information blocks.

Designing educational resources in crisis situations is a complex but extremely important process that requires a systemic, interactive, multimedia, accessible, safe, and relevant approach. Adhering to these principles not only ensures the continuity and quality of education during trials but also creates a foundation for the sustainable development of HEIs and the training of highly qualified specialists capable of overcoming future challenges. For Ukraine, this is a key element of the reconstruction and development strategy.

Designing educational resources in a crisis is an iterative process that demands flexibility, speed, and constant adaptation. Unlike normal conditions where the stages can be more linear, in a crisis (especially during a war), each step may require immediate adjustments. However, following the key stages ensures a systemic and effective approach.

1. Needs Analysis

This is the initial and critically important stage that determines exactly what needs to be created and for whom. In a crisis, it must be fast and accurate.

What we analyze. Target Audience: Who will use the resources? (students, instructors, schoolchildren, adults, IDPs). What are their technical capabilities (access to the internet, devices), psychological state, and prior experience? Current Challenges: What specific aspects of the educational process are disrupted by the crisis? (e.g., inability to hold in-person classes, lack of access to laboratories, psychological pressure). Educational Gaps: What knowledge and skills need to be urgently developed (e.g., safety, first aid, cyber hygiene, adaptation to new working conditions)? Available Resources: What materials, equipment, and specialists are already available and can be used or adapted.

Special considerations in a crisis: There is a need for rapid information gathering (online surveys, focus groups, analysis of the current situation in different regions). Needs can change very quickly.

2. Design

At this stage, the concept of the educational resource, its structure, and functionality are developed, taking into account the identified needs and principles (systemic approach, interactivity, multimedia, accessibility, security, relevance).

What we design. Learning Goals: What should users achieve after interacting with the resource? Content: What material will be included, and how will it be structured (modules, topics)? Formats: What multimedia elements will be used (video, animation, text, simulations)? Learning Methods: How will the material be presented (lectures, case studies, practical assignments, tests)?

Platform: What platform will host the resource (LMS, website, mobile app)? Navigation and Interface: How the user will interact with the resource to make it intuitive. Security Requirements: Cybersecurity and data protection measures.

Special considerations in a crisis: Flexibility in design—the plan can be changed at any moment. The priority is simplicity, functionality, and ease of use, not excessive complexity.

3. Development

This is the stage of directly creating the educational resources according to the developed design.

What we do. Content Creation: Writing texts, recording video lectures, developing animations, simulators, and tests. Technical Implementation: Programming interactive elements, uploading materials to the platform, and setting up access. Testing: Checking functionality, correct display on various devices, and the absence of errors.

Special considerations in a crisis. Speed: The need for rapid development, often using a minimally sufficient set of functions. Using ready-made tools: Priority is given to ready-made platforms and services that do not require complex development from scratch. Distributed team: The ability for developers to work from different locations.

4. Implementation

At this stage, the educational resources become available to the target audience, and their use begins.

What we do. Deployment: Placing resources on the platform and configuring access for users. Communication: Informing the target audience about the availability of the resources and providing instructions for their use. Support: Providing technical and methodological support for users.

Special considerations in a crisis. Phased implementation: Launching resources in parts to provide access to critical information as quickly as possible. Active communication: Constant contact with users, taking into account their needs and access problems. Prioritizing access: Ensuring priority access for the most vulnerable groups.

5. Evaluation.

The stage of evaluating the effectiveness of educational resources, their compliance with the set goals, and user needs.

What we evaluate. User satisfaction: How satisfied students and instructors are with the resources (surveys, feedback). Achievement of educational goals: Whether students are achieving the desired learning outcomes (analysis of performance, completion of tasks). Technical functionality: Stability of operation, absence of

failures, and download speed. Accessibility: Whether the resource is truly accessible to all categories of users. Relevance: Whether the content corresponds to modern realities.

Special considerations in a crisis: Fast feedback—the evaluation must be operational to quickly identify problems. Using platform analytics tools to collect data.

6. Correction/Refinement

Based on the evaluation results, changes and improvements are made to the educational resources.

What we correct. Content: Updating data and adding new information. Functionality: Fixing errors, improving the interface, and adding new features. Formats: Changing the ways the material is presented if they were found to be ineffective. Implementation strategy: Adapting methods for distributing resources.

Special considerations in a crisis: It is an iterative process—correction happens continuously; it is not a one-time stage but a cyclical process that allows resources to evolve along with the changing crisis situation and needs.

The stages of designing educational resources in crisis situations are interconnected and cyclical. They require developers and managers to have a high degree of adaptability, the ability to respond quickly, and continuous analysis. Adhering to these stages, even in a simplified form, makes it possible to create effective, relevant, and sustainable educational resources, which is key to ensuring the continuity and quality of education in the face of unpredictable challenges.

A Learning Management System (LMS) is a software platform that provides a comprehensive set of tools for creating, hosting, organizing, managing, and delivering electronic learning courses, as well as for administering the educational process. Most Popular LMS in Ukraine and the World. Moodle: The most common in Ukrainian HEIs due to its open-source nature, flexibility, and extensive functionality.Google Classroom: Simple to use and integrated with other Google services, making it convenient for basic needs. Zoom, Microsoft Teams, Cisco Webex: While not full-fledged LMS platforms, they are widely used for conducting synchronous online classes (video conferences) as a supplement to main platforms. Coursera for Campus,

edX for Business: Commercial platforms offering access to courses from leading global universities, adapted for corporate and institutional learning. Key LMS Features. Content Management: Uploading and organizing learning materials (texts, presentations, videos, audio). Course Management: Creating, editing, and archiving courses, as well as assigning instructors and students. Communication Tools: Forums, chats, private messages, announcements, and the ability to hold webinars and video conferences. Assessment Tools: Tests, assignments, essays, gradebooks, and the ability to provide feedback. Monitoring and Analytics: Tracking student progress, activity, and statistics on visits and task completion. User Management: Registration, authorization, and role management (administrator, instructor, student). Integration: The ability to integrate with other HEI systems (student databases, library systems). Stages of Developing and Implementing Innovative Resources (with a focus on Electronic Courses and LMS):

1. Strategic Planning and Needs Analysis. Defining the goal of implementation (e.g., transitioning to distance learning, improving quality, expanding access). Analyzing the needs of the target audience and the technical capabilities of the HEI and students. Selecting an LMS that meets the needs and budget.
2. Course Design and Development. Designing the course structure, learning goals, and assessment methods. Creating multimedia content (recording videos, developing interactive elements). Adapting existing materials for the online format. Special consideration in a crisis: Prioritize speed, functionality, and a minimally sufficient set of materials to ensure continuity.
3. LMS Implementation and Support. Installing and configuring the chosen LMS (for open-source solutions) or connecting to a cloud service. Training instructors and students on how to use the platform and its tools. This is a critically important stage that requires constant methodological support. Providing technical support for users. Special consideration in a crisis: Rapid deployment, informational work, and providing access to platform tutorials.
4. Monitoring, Evaluation, and Correction. Collecting feedback from students and instructors. Analyzing data on course and platform usage. Assessing the

achievement of educational goals. Regularly updating content and LMS functionality in accordance with identified needs and changes in the external environment. Special consideration in a crisis: Constant monitoring of the situation, quick response to failures, and adaptation to new security challenges (lack of electricity/internet).

Challenges in Implementation in Ukraine. Material and Technical Base: Insufficient level of modern computers and high-speed internet access for both HEIs and students. Digital Competence: The need for further professional development for instructors in the area of online course development and teaching. Energy Security: Power and internet outages due to Russian attacks are a major obstacle to distance learning, requiring alternative solutions (downloading materials, synchronous and asynchronous modes). Cybersecurity: Ensuring the protection of data and platforms from cyberattacks.

Despite the challenges, electronic courses and LMS are key tools for modernizing Ukrainian education, ensuring its stability in wartime, and integrating it into the global educational space. Their potential for providing quality, accessible, and flexible education is limitless.

The development of technologies, especially in conditions of limited access to real equipment and production facilities (as is often the case during crises or due to the high cost of modern agricultural equipment), brings virtual laboratories and simulators to the forefront of the agrarian education system. These innovative educational resources allow students to gain practical experience, practice skills, and study complex processes in a safe, controlled, and accessible digital environment. Virtual Laboratories: Software complexes that imitate real laboratory research and experiments, allowing students to perform practical work, manipulate virtual equipment, collect data, and analyze results. Simulators: Programs that reproduce the behavior of a real system or process, giving the user the ability to interact with it and observe the consequences of their actions (e.g., controlling machinery, imitating biological processes). Key Benefits for Agrarian Specialties

Virtual laboratories and simulators offer significant advantages for agricultural education, particularly in a crisis. Accessibility and Scalability: They provide 24/7 access, overcoming geographical barriers for students who are remote or abroad. They also allow HEIs to train students on expensive, modern equipment—like high-precision tractors and combines—that they couldn't otherwise afford. Safety and Control: Students can practice dangerous operations (e.g., using pesticides) without risk to their health or equipment. The simulations offer a controlled environment where experiments can be repeated under perfect conditions. This also allows for detailed data analysis of a student's actions, helping instructors identify common mistakes and provide targeted feedback. Learning Efficiency and Personalization: These tools make complex processes visible, such as nutrient movement in plants or microorganism development. Their interactivity and unlimited repeatability improve student engagement and mastery of the material. Adaptive simulators can also personalize the learning experience by offering tasks of varying difficulty based on the student's skill level.

Agronomy: Students can use simulators to practice crop cultivation, analyze soil composition in virtual labs, model the effects of plant diseases and pests, and learn precision farming techniques using GPS navigation and drones. Animal Science and Veterinary Medicine: Simulators can teach animal care procedures, while virtual anatomy tables allow students to study animal anatomy in 3D and perform virtual dissections. Agricultural Engineering: Simulators can be used for operating agricultural machinery, modeling irrigation systems, and designing and testing new farm equipment in a virtual environment.

Challenges of Implementation

While the benefits are great, there are challenges to consider. High Development Cost: Creating high-quality virtual labs and simulators is a resource-intensive process that requires significant financial and personnel investment. Realism and Authenticity: To be effective, the models must be highly realistic and scientifically accurate. Technical Requirements: Some simulations require powerful hardware and a stable internet connection. Integration: HEIs must adapt their curricula and train instructors

to effectively use these tools. Lack of Tactile Feedback: Simulators cannot fully replace the physical experience of working with real equipment, which is essential for developing "muscle memory" and fine motor skills.

Despite these challenges, virtual laboratories and simulators have huge potential to modernize agrarian education. They allow HEIs to provide high-quality practical training, increase accessibility, reduce risks and costs, and adapt the educational process to the rapidly changing needs of the agro-industrial complex. Their implementation is a strategic priority for Ukrainian education, which aims to train competitive specialists for the country's recovery and development.

Online Resources for Self-Directed Learning

In a modern world where knowledge becomes obsolete at a rapid pace and the labor market is constantly changing, self-directed learning and continuous development are not just desirable but necessary for a successful career and personal growth. Online resources play a key role in this, providing unprecedented opportunities to access information, acquire new skills, and improve qualifications. For Ukrainian students and specialists, especially in a state of war, these resources are a vital tool for support and development. Reasons for the Growing Popularity of Online Resources for Self-Directed Learning. Accessibility: Most resources are available from anywhere with internet access, often for free or at a moderate cost. Flexibility: The ability to learn at one's own pace, choosing a convenient time and place, allows for combining learning with work, personal life, or volunteer activities. Relevance: Leading online platforms regularly update their content, reflecting the latest trends in science, technology, and business. Wide Selection: They cover virtually all fields of knowledge, from the humanities to high-tech and agriculture. Personalization: Many platforms offer personalized recommendations and adaptive learning paths.

Main Types of Online Resources and Their Characteristics:

1. Massive Open Online Courses (MOOCs): Courses developed by leading universities and companies worldwide, available to a large number of students. They usually have structured material, video lectures, assignments, and discussion forums. Platforms: Coursera, edX, FutureLearn, and the Ukrainian platform Prometheus, which

offers courses in partnership with leading Ukrainian HEIs. Advantages: High-quality content, the possibility of obtaining a certificate (often for an extra fee), and access to knowledge from global experts.

2. Specialized Online Platforms for Skills Development: Focused on specific fields or practical skills training. Platforms: Udemy, Skillshare, and LinkedIn Learning, which offer a wide selection of practical courses, including IT skills for the agricultural sector, marketing, and management. Khan Academy for basic disciplines and Duolingo for learning foreign languages.

3. Video Hosting and Educational Channels: YouTube is a huge source of educational content. Many universities, research institutes, and experts create channels with lectures and demonstrations. In the agricultural field, this includes channels from research institutions, agricultural machinery companies, and farmer-bloggers. Advantages: Free access, visualization of complex processes, and the ability to see the practical application of knowledge.

4. Electronic Libraries and Repositories: Provide access to scientific articles, books, dissertations, and methodological materials in a digital format. Examples include Google Scholar, ResearchGate, and the electronic libraries of Ukrainian HEIs. Advantages: Access to academic and research works, which are the basis for in-depth study and scientific activity.

5. Professional Communities and Forums: Platforms for sharing experiences, discussing problems, and finding solutions. Examples include specialized groups on Facebook, LinkedIn, and professional forums for agronomists, veterinarians, and engineers. Advantages: The ability to get advice from practitioners, find partners, and stay current with the latest industry trends. Importance for Ukraine in a Crisis. Learning Continuity: Even with limited access to traditional HEIs, online resources allow for continuous education. Knowledge Relevance: Quick access to up-to-date information and technologies necessary for the country's recovery and development, especially the agricultural sector. Mental Health Support: The ability to continue learning can be a source of stability during difficult times. Access to International

Experience: Ukrainian specialists can study advanced global practices, which is critical for European integration and competitiveness.

Online resources for self-directed learning are a powerful tool that democratizes education, making it accessible, flexible, and relevant. They allow everyone to become the architect of their own educational path, constantly updating knowledge and skills, which is the key to success in a dynamic world. For Ukraine, the active use and development of such resources are a key element of the reconstruction strategy and the formation of a competitive human capital.

In modern education, especially during times of constant change and crisis, traditional teaching methods based primarily on knowledge transfer are no longer sufficient. Interactive approaches that develop critical thinking, problem-solving skills, teamwork, and adaptability are coming to the forefront. Case-based learning and project-based learning are among the most effective tools for achieving these goals. Their application, considering the experience of the crisis, allows for training specialists who can act effectively in complex and unpredictable conditions.

Case-based learning is a teaching method where students analyze and solve specific situations (cases) that reflect real or hypothetical problems in a certain field. Students, working in groups or individually, analyze the situation, identify problems, propose solutions, and justify their choices. Key Features with Crisis Experience in Mind. Use of Real Crisis Cases: Analyzing cases related to the functioning of agricultural enterprises during wartime, such as transporting crops through blocked ports, restoring production in liberated territories, and operating in conditions of fuel or electricity shortages. Developing Critical Thinking and Decision-Making under Uncertainty: Crisis-based cases rarely have a single "right" solution. This encourages students to analyze deeply, evaluate risks, and find non-standard approaches. Building Stress Resistance and Adaptability: Discussing complex situations helps students mentally prepare for future challenges and develop the ability to stay calm and make rational decisions under pressure. Teamwork and Communication: Solving crisis cases often requires an interdisciplinary approach and effective teamwork, including exchanging ideas and defending one's position.

Project-based learning is a method where students work on a real or simulated project over a period of time, solving a specific problem or creating a product. It's an active, practice-oriented approach that develops a wide range of skills. Key Features with Crisis Experience in Mind. Projects Focused on Solving Current Problems: Developing projects for the restoration of agricultural lands after demining, rebuilding farms, or optimizing logistics for agricultural exports. Interdisciplinarity: Crisis situations often require integrated solutions that go beyond a single specialty. Project-based learning can bring together students from different fields (agronomists, engineers, economists) to work together on a complex project. Developing Self-Organization and Responsibility: Students manage their projects independently, plan work, and assign tasks, which fosters autonomy and accountability. Close Collaboration with Business and Stakeholders: Involving real agricultural businesses, local authorities, and non-governmental organizations in project-based learning allows students to work on real-world problems and gain practical communication experience. Building Resilience and Adaptability: Working on projects with limitations (time, financial, security) teaches students to find solutions in difficult situations, adapt their plans, and seek out unconventional solutions. Challenges and Prospects of Application. Access to Current Data: Getting access to real data for cases and projects can be difficult during wartime. Instructor Training: Educators need to be facilitators and mentors, not just sources of knowledge. Resources: Some projects may require specialized software, equipment, or consultants. Security: The security situation must be considered when implementing on-site projects.

Implementing case-based and project-based learning that accounts for crisis experience is a powerful tool for modernizing agricultural education in Ukraine. It will help train not just specialists, but leaders of change who can not only adapt to challenges but also actively participate in the reconstruction and development of the country's agricultural sector.

In the modern agricultural sector, which is rapidly developing under the influence of technological innovations and global challenges, access to up-to-date, verified information and best practices is critically important. The creation of databases

of advanced agricultural experience is a strategic tool that allows for the accumulation, systematization, and dissemination of knowledge to optimize production processes, increase efficiency, and promote the sustainable development of the industry. For Ukraine, which is undergoing a period of reconstruction and modernization of the agricultural sector, this task is particularly relevant. Why are databases of advanced agricultural experience important?

Creating databases of advanced agricultural experience is a strategic tool that allows for the accumulation, systematization, and dissemination of knowledge to optimize production processes, increase efficiency, and promote the sustainable development of the industry. For Ukraine, this task is particularly relevant. Key Benefits

1. Accelerating Innovation: Provides farmers, agronomists, scientists, and students with quick access to information on new technologies, plant varieties, animal breeds, and cultivation and management methods.
2. Increasing Productivity and Efficiency: Allows users to study successful case studies, avoid common mistakes, and implement proven solutions to optimize production.
3. Adapting to Change: Access to adapted solutions is vital in the face of climate change, new pests, diseases, or shifting market conditions.
4. Supporting Decision-Making: Provides data to justify management decisions at various levels, from individual farms to regional and national strategies.
5. Education and Development: Serves as a valuable educational resource for higher education institutions, students, and professionals in need of continuous learning.
6. Reducing Losses: The experience of successfully overcoming crises or applying certain technologies helps minimize losses of resources, time, and crops.

These databases can vary in scope, subject matter, and level of detail, but they should include the following types of information. Agrotechnology and Innovation Data. Precision agriculture: Data from field monitoring (satellite images, drone data), yield maps, soil maps, and protocols for differentiated application of fertilizers and

plant protection products. Biotechnology: Information on new plant varieties, hybrids, breeding methods, bio-fertilizers, and bio-pesticides. Robotics and Automation: Data on the effectiveness of using autonomous machinery, robotic systems, and IoT sensors. Energy Efficiency: Examples of implementing alternative energy sources (solar panels, biogas plants) and their economic feasibility. Management and Business Data: Business plans and financial models: Examples of successful business models in various agricultural sectors. Marketing strategies: Experience entering new markets, promoting products, and branding. Risk management: Case studies on overcoming economic, climatic, and logistical risks. Natural and Climatic Data. Weather data: Historical and forecast weather data that impacts agricultural planning. Soil data: Soil maps, their composition, and recommendations for cultivation. Agro-landscape planning: Examples of effective land use and biodiversity preservation. Experience in Overcoming Crisis Situations (especially for Ukraine). Production recovery: Case studies on successfully restarting agricultural enterprises in de-occupied territories, demining land, and restoring infrastructure. Wartime logistics: Information on alternative export/import routes and experience with "grain corridors." Ensuring security: Examples of adapting agricultural production to combat conditions (protecting machinery, workers, and crops). Social projects: Experience supporting farmers and communities affected by the war. Veterinary Medicine and Animal Science. Data on new methods for diagnosing and treating animal diseases. Information on effective feeding and housing systems, and animal genetics. Stages of Database Creation and Challenges

The process of creating these databases involves several key stages.

1. Defining the Goal and Target Audience: Clearly understand who the database is for and what tasks it needs to solve.

2. Information Collection and Systematization: Systematically gather data from various sources: scientific research, agricultural enterprise reports, farmer experience, international publications, and monitoring data.

3. Validation and Verification: Check the accuracy and relevance of the information and involve experts to evaluate the best practices.

4. Technical Implementation: Select a platform (specialized databases, cloud solutions, web portals) and develop a user-friendly interface.

5. Content Population and Constant Updates: Regularly add new data and update existing information.

6. Promotion and Training: Inform potential users about the database's existence and conduct training sessions on how to use it.

There are also significant challenges. Data Reliability: Ensuring verified information and avoiding fake or outdated data. Confidentiality: Protecting commercial and personal information. Funding: Creating and maintaining databases requires significant investment. Integration: The ability to combine data from various sources. Motivation for Knowledge Sharing: Incentivizing agricultural professionals to share their successes and failures.

The creation of databases of advanced agricultural experience is a strategic step for the development of the Ukrainian agricultural sector. It is a powerful tool for rapid adaptation to change, implementing innovations, and increasing competitiveness. The active participation of HEIs, research institutions, agricultural enterprises, and the government in this process will allow for the creation of a unique knowledge ecosystem that will become the driving force for the recovery and sustainable development of Ukraine's agricultural sector.

The effectiveness of educational resources is not just about their existence but their ability to ensure quality learning and achieve set educational goals. In a crisis, when traditional approaches can be disrupted, evaluating resource effectiveness becomes especially important. This helps HEIs quickly adapt and optimize the learning process using key criteria for a comprehensive assessment.

Accessibility is the ability of an educational resource to be reachable and usable by all students, regardless of their physical abilities, technical equipment, location, or other circumstances. If a resource is not accessible, it cannot be effective, as no one will be able to use it. During a crisis—with power outages, limited internet, and displaced persons—accessibility is critical.

Evaluation Metrics. Technical accessibility: Compatibility with various devices (PCs, laptops, tablets, smartphones), operating systems, and browsers. Optimization for low internet speeds and the ability to download materials for offline viewing. Physical accessibility: Usability for people with special educational needs (subtitles for videos, text-to-speech, the ability to change font size and contrast). Geographical accessibility: No restrictions based on the user's location. Financial accessibility: Free access or a moderate cost. Ease of access: A minimum number of steps to register and start using the resource.

The quality of an educational resource includes its pedagogical value, scientific validity, methodological soundness, and technical execution. High-quality resources contribute to deep and lasting knowledge acquisition, the formation of correct skills, and a positive attitude toward learning.

Evaluation Metrics. Scientific validity: The content's relevance and accuracy based on current scientific research and data. Methodological soundness: Clear learning objectives, a logical structure, a variety of information delivery methods, and appropriateness for age and psychological characteristics. Clarity and visualization: The quality of images, videos, and animations that help users better understand the material. Completeness and sufficiency: Whether the resource contains all the necessary information to achieve its stated goals. Technical quality: The absence of errors (typos, logical, software), clear audio and video, and the stable operation of all elements.

Relevance means that the content and functionality of an educational resource align with the needs of students, the demands of the labor market, and the strategic development goals of the industry or country. Relevant resources train specialists who are in demand, can solve real-world problems, and contribute to development. During a crisis, relevance also includes how well the materials address security and social challenges.

Evaluation Metrics. Labor market alignment: Does the resource develop the skills and knowledge that employers need today and will need tomorrow? (e.g., for agriculture: precision farming, digitalization, restoration). Information timeliness:

How quickly is the information updated to reflect the latest technologies and changes? Practical value: Can the knowledge and skills gained be applied in practice? Alignment with crisis challenges: Does the resource contain information or methods that help users adapt to war conditions, reconstruction, etc.? Learning objectives: Does the resource align with the stated goals of the educational program?

Usability is the degree to which a user can easily and effectively interact with an educational resource to achieve their learning goals without unnecessary effort. Even the highest-quality and most accessible resource will be ineffective if it is difficult to use. Usability reduces frustration and increases motivation to learn.

Evaluation Metrics. Intuitive interface: Simple navigation, logical layout of elements, and clear instructions. Efficiency: Fast page loading speeds and quick response times for interactive elements. Attractive design: Aesthetic appearance, a pleasant color scheme, and readable fonts. System feedback: Clear error messages and action confirmations. Learning support: The presence of help materials, FAQs, and the ability to ask for assistance.

Evaluating educational resources based on these criteria—accessibility, quality, relevance, and usability—allows HEIs to measure the success of their initiatives and continuously improve the learning process. In a crisis, regular and comprehensive evaluation using these criteria is the foundation for making informed decisions about developing, implementing, and correcting educational resources, ensuring their maximum benefit for students and society.

In a crisis, particularly during wartime, collecting quick and accurate data on the effectiveness of educational resources is crucial. This allows for a rapid response to challenges, adapting teaching materials and methods, and ensuring the continuity of the educational process. However, traditional data collection methods can be difficult, requiring a flexible approach and the use of accessible tools. Here are the key methods for collecting data on educational resources during a crisis.

A survey is a way to collect information from a large number of respondents using standardized questions. Surveys can be anonymous, which encourages more candid responses.

Features and Advantages in a Crisis. Mass reach: You can reach a large number of students, instructors, administrators, and parents. Flexible formats: Online surveys (Google Forms, SurveyMonkey, Miro, Mentimeter) allow you to quickly create and distribute a questionnaire, as well as automatically collect and analyze data. If needed, you can use phone surveys or simplified paper forms if online access is limited. Needs assessment: They quickly gather information about technical capabilities (internet access, devices), access problems, and preferences for content and format. Satisfaction evaluation: They help assess overall attitudes toward resources, usability, and quality.

Challenges. Digital divide: Not everyone has stable internet access to complete online surveys. Low motivation: In stressful conditions, respondents may be less motivated to complete long surveys. Superficial answers: Closed-ended questions may not provide a deep understanding of the problem.

A focus group is a qualitative research method that involves a group discussion on a specific topic (usually 6-10 participants) led by a moderator.

Features and Advantages in a Crisis. In-depth understanding: Allows for detailed answers and a deeper understanding of the reasons behind problems, as well as the identification of hidden needs and emotions that surveys can't capture. Interaction: Discussion among participants can stimulate new ideas and highlight different viewpoints. Flexibility: Can be conducted online (via Zoom, Google Meet) or offline (if possible and safe). Especially useful for: Understanding the psychological impact of a crisis on the perception of educational resources and identifying issues with interactivity or motivation.

Challenges. Difficulty of organization: Requires an experienced moderator, and it's harder to gather a group due to displacement and restrictions. Small data volume: The data is not statistically significant for the entire audience but provides a qualitative understanding. Moderator influence: The moderator can unconsciously influence participants' answers.

Usage statistics analysis is the collection and analysis of quantitative data on user interaction with educational resources and platforms. This data is automatically collected by learning management systems (LMS) and web analytics tools.

Features and Advantages in a Crisis. Objectivity: The data reflects users' actual behavior, not their subjective opinions. Speed: Data collection is automatic and in real time, allowing for the quick identification of trends. Identification of "bottlenecks": You can track which resources are least popular, at which stages students drop out, and which tasks cause the most difficulty. Accessibility evaluation: Analyzing the geography of logins, device types, and access times helps assess the actual accessibility of resources.

Metrics Analyzed. Number of unique users and visits: How many people and how often they access the resource. Time spent on the resource: How long users interact with the materials. Course/module completion rate: How many students successfully complete a course. Test and assignment results: Performance and common errors. Activity in forums/chats: The level of interaction and communication. Device and browser types: Information for resource optimization. User geographic data: To understand where students are located (useful for identifying IDPs).

Challenges. Data interpretation: Statistics show the "what," but not always the "why." Other methods are needed to understand the reasons. Platform technical capabilities: Not all platforms provide deep enough analytics. Confidentiality: The need to comply with personal data protection rules when collecting and using statistics. Interviews: In-depth conversations with key stakeholders (e.g., individual students, innovative instructors, administrators) to get very detailed information. Journals/Reflective Reports: Asking students to keep a diary of their impressions and problems while learning. Observation: Monitoring student behavior during online classes (with their consent).

Each of these methods has its advantages and disadvantages, especially in a crisis. The most effective approach is a combination of methods (data triangulation). For example, start with a broad online survey to identify general trends, then conduct focus groups to get an in-depth understanding of the problems found, and simultaneously analyze usage statistics for objective confirmation of hypotheses. This allows HEIs to quickly and accurately adapt their educational resources, ensuring maximum learning effectiveness even in the most difficult conditions.

In a modern world of rapid change, especially during prolonged crises like the war in Ukraine, a higher education institution's (HEI) ability to quickly correct and update educational resources is not just desirable—it's critical. This allows them to maintain the relevance of learning content, respond to new challenges, and ensure the continuity and quality of the educational process.

To effectively and quickly update resources, well-established mechanisms are essential.

The foundation of rapid correction is the constant collection and analysis of information on resource usage. Learning Management Systems (LMS): Use the built-in analytics tools of your LMS (Moodle, Coursera for Campus, Google Classroom) to track student activity, such as page views, time spent on a page, test results, and comments. This helps identify "bottlenecks," confusing sections, or outdated information. Surveys and Focus Groups: Conduct regular, short surveys with students and instructors (via Google Forms, SurveyMonkey) and hold focus groups to gather qualitative feedback on usability, content quality, and relevance. Direct Feedback: Encourage students and instructors to directly report errors, inaccuracies, or suggestions for improvement through special forms on platforms or via email. Monitoring the Labor Market and Industry Changes: Continuously analyze the current requirements for specialists from employers and track new technologies and research in the agricultural sector. This can be done through professional associations, conferences, and collaboration with businesses. Monitoring the Security Situation: For Ukraine, this includes tracking changes on the front lines, the risks of shelling, and power supply issues, which directly impact the format and content of resources.

The structure of educational resources should be designed to allow for easy changes. Modular Principle: Break down educational courses into small, self-contained modules or topics. This lets you update or replace individual modules without having to rework the entire course. Use of Templates: Develop standardized templates for creating learning materials. This speeds up development and updates while ensuring a consistent style and quality. Cloud Technologies: Host resources in cloud storage and on platforms that allow for remote updates and access from anywhere. Open Formats:

Use open file formats that are easy to edit and convert, as well as Open Educational Resources (OER) that can be freely adapted.

Use technological solutions to speed up and simplify the process of making changes. Version Control Systems: Use systems like Git to track changes in code or content. This makes it easy to revert to previous versions, allows a team to work on a single resource, and records all changes. Automated Content Creation Tools: Use specialized software that simplifies the creation and editing of multimedia materials and interactive elements. Data Integration: Connect the LMS with databases of up-to-date information (e.g., weather data for agricultural simulators, yield data) to automatically update certain elements.

Effective updating is impossible without a coordinated team and relevant competencies. Responsible Individuals: Appoint individuals responsible for the relevance and updating of specific sections or courses. Content Development Teams: Form multidisciplinary teams that include subject matter experts, methodologists, multimedia specialists, designers, and IT specialists. Systematic Professional Development: Train instructors and staff to use the tools for creating and updating digital resources, as well as methods for rapid adaptation of learning material. Involvement of Practical Experts: Maintain constant cooperation with business representatives and practicing scientists to get the most current information and experience. Flexible HEI Policy: Develop internal regulations that allow for quick changes to educational programs and course descriptions. Funding: Allocate a budget for the continuous updating of software, purchasing tools, and paying specialists for resource development and support. State Support: Adapt higher education standards to rapid changes, simplifying licensing and accreditation procedures for innovative programs.

Mechanisms for rapid correction and updating of educational resources are an integral part of a modern education system. For Ukraine, which is striving for reconstruction and European integration, their effective implementation is key to training highly qualified specialists who can quickly adapt to any challenges and contribute to the country's innovative development. This allows Ukraine to not just

react to crises, but to emerge from them stronger, with a more flexible and relevant education system.

Conclusions

The prospects for developing the educational resource design system for Ukrainian agrarian higher education institutions (HEIs) are incredibly broad and ambitious. Integrating artificial intelligence, virtual reality, and blockchain, along with developing micro-credentials, strengthening cooperation, and deeply adapting to crisis experiences, will allow these HEIs to become leaders in training the specialists of the future. This will not only ensure high-quality education but also contribute significantly to the reconstruction, innovative development, and food security of Ukraine.

This study delves deeply into the issues and outlines key approaches to the theory and methodology of designing educational resources for agrarian HEIs in crisis situations. It underscores the urgent need to adapt the educational process to extreme challenges and defines pathways for its sustainable development and innovative growth. Crisis situations, particularly the experience of full-scale war, demand a fundamental rethinking of educational content. Educational resources must not just reflect but also integrate this experience, offering students case studies and project-based learning that model real-world challenges for the agricultural sector. This includes skills in restoring destroyed production facilities, optimizing logistics under restrictions, working in demined areas, and ensuring food security. This approach builds not only professional but also vital life skills like resilience, adaptability, and quick decision-making.

Effective educational resource design in a crisis is only possible with a systemic approach. The developed model outlines a cyclical process that includes needs analysis, design, development, implementation, evaluation, and rapid correction. This approach ensures resources are accessible, high-quality, relevant, and user-friendly, which is critical for ensuring continuous learning and training qualified personnel. The success of designing and developing educational resources depends directly on effective data collection methods. Combining surveys, focus groups, and usage statistics analysis provides both quantitative effectiveness indicators and deep

qualitative insights. This allows for an objective analysis of the pilot results and the identification of the model's strengths and areas for improvement, considering the specific operational conditions of HEIs in various crisis situations. In conditions of constant change and uncertainty, mechanisms for the rapid correction and updating of educational resources play a crucial role. A flexible modular structure, the use of modern technologies, a clear distribution of responsibilities, and well-established procedures for a quick response allow for the swift adaptation of educational content to new challenges, current technologies, and changing needs. For the educational resource design system to function and develop fully in a crisis, it is critically important to improve the regulatory framework. This involves legally defining the status of digital educational resources, allowing for flexible learning formats, creating funding mechanisms for digitalization, incentivizing instructors, and regulating the use of best-practice databases. The future of the educational resource design system for agrarian HEIs is tied to the integration of new technologies like artificial intelligence, virtual and augmented reality, and the Internet of Things. This opens up new opportunities for personalized learning, immersive simulations, developing micro-credentials, and creating a holistic learning ecosystem. Strengthening cooperation with agribusiness and international partners, along with developing open educational resources, will be catalysts for innovation and sustainable development.

Ultimately, the developed theory and methodology for designing educational resources are a viable and adaptive response to modern challenges. Their implementation and continuous improvement, with appropriate support at all levels, will allow Ukraine's agrarian HEIs to not only effectively train highly qualified specialists for the country's reconstruction but also to take leading positions in the global system of agrarian education and science.

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