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## DEVELOPMENT PERSPECTIVES OF CLOUD TECHNOLOGIES IN THE EDUCATION SYSTEM DURING THE PANDEMIC

**Abstract.** *The article investigates the education system, as the main attribute of the knowledge economy, examines the changes in the education system of Azerbaijan. The samples were presented on the application of innovative technologies in higher education institutions of foreign countries in connection with the transition from traditional education to cloud. The article factors influencing the effectiveness of the cloud system have been considered, as well as the importance of studying the organization, economic bases, and principles of the application of e-learning management systems in educational institutions from methodological, theoretical, and practical sides have been determined. Economic development of cloud technologies, and examples from international experience of changes in the education system has been demonstrated.*

**Keywords:** *higher education, the education system, cloud technologies, innovative technologies, e-training, information technologies, e-learning.*

### INTRODUCTION

In present-day, the main task of Azerbaijan is not to stay behind the development process of the world, to increase the efficiency and competitiveness of the economy, and to ensure its innovation-based progress. This involves the formation of a new economic model, changes in the education system, and the development of ICT and science. For this purpose, the principles of effective state regulation and a comprehensive approach to the development of socio-economic fields, ensuring healthy competition in a business economy, should be followed, and the innovative development of the economy should be taken as a basis.

Although each of these three areas retains its relative independence, it is impossible to imagine any of them without the other. We are currently observing the intersection of 3 different fields.

The transition of information technology to other fields requires an appropriate professional level of specialists and minimal information knowledge of users [2].

Also, for creation of new technologies, there must be new scientific knowledge and mechanisms for the transformation of this knowledge to a commercial product (service). So, the “knowledge economy” is also a main condition for the dissemination of ICT and information (**Fig. 1**).

Innovation ultimately leads to economic development and changes in living standards mobilizing all components of the knowledge economy.

Makhlup F. in his book “Production and dissemination of knowledge” published in 1962 divided the knowledge industry into 5 groups: scientific research, education, mass media (MM), information technologies (IT), information services (**Fig. 2**) [5].

Thus, Makhlup includes the three groups of human activities to the information. He shows the essential role of technology, information service, means in human activity.

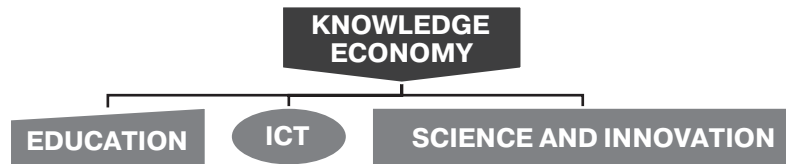
The analysis conducted as an object of economic research on innovative technologies called cloud management systems shows that the usage of the system in education is increasing presently.

Cloud technology is a service capable to process and store large amounts of information without local resources.

Cloud technologies constitute the basis for new changes in the development of both business and society, suggesting a variety of jobs for IT professionals. Cloud platform components (**Fig. 3**).

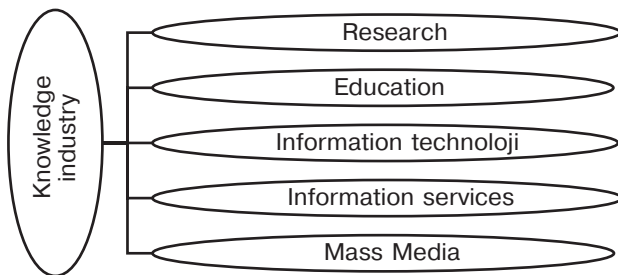
Each component has its own usage scenario, and each component can contain several components.

The cloud management system is more effective than traditional education.



**Fig. 1.** The core of the knowledge economy

Source: author's work.



**Fig. 2.** Components of knowledge industry

Source: author's work.

Analysis of the cloud management system shows that in the current pandemic, the usage level of this system in education is increasing. Over the past year, we observed that the cloud management system is more cost-effective than traditional education.

Thus, higher education institutions have free access to Microsoft's MS Teams platform provided by the Ministry of Education. Today, Microsoft Teams with more than 44 million users is a platform for sharing, talking, and sharing files electronically in teams, classes or groups.

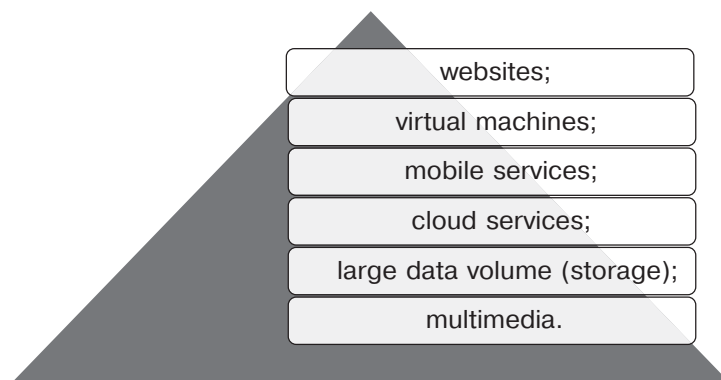
The Microsoft Teams platform with the sections such as Activity, Chat, Teams, Messages, and Files, includes documents shared within a group and the ability to work together on these shared documents. In addition to text chat, video calling, and screen sharing, Microsoft also has the ability to sync documents to OneDrive cloud storage.

The Microsoft Teams platform provides distance learning for higher education institutions through video linking, the use of interactive elements for teachers and students, the transfer of syllabi, lectures, and other teaching materials, the placement of large-scale training materials, calendar training and online lectures, and lesson planning, organization of assessment of student's knowledge.

In addition, the internal opportunities of higher education institutions such as ZOOM, MOODLE, Google Classroom, Blackboard Collaborate are widely used in the organization of distance learning processes. These training management systems are designed for a large number of students and aimed at conducting corporate training in educational institutions.

The main features are the control to a certain part of the course, the date of students' admission to the course, the number of admissions, the process of passing the course. This system allows the user to register for listening to the course and send a reminder to the registered user about the next online courses. In the system, students are free to check their exam results. In addition, they can chat and have the opportunity to participate in various social groups [11].

Investigations show that the technological perspective fields are mainly occurs in three directions: mobile, cloud, biometric. The constant development of mobile and cloud technologies,



**Fig. 3.** Components of knowledge industry

Source: author's work.

as well as their interaction, creates a new business model. By using products in the cloud sphere, it provides stock opportunities in a virtual environment.

Cloud products allow professionals to increase their knowledge in the field of innovative technologies without leaving their position. Experts have the opportunity to gain the necessary knowledge in the cloud. Concerning this approach, we can say that the technology of creating and disseminating new innovative knowledge requires the widespread application of new educational ideas in the education system. Because the development of the technological infrastructure of each country is determined by the number of specialized specialists.

As seen from the statistics given by the International Association of Science Park, the existence of electronic environment and access to electronic resources plays an important role in the development of technoparks, strengthening the capacity of specialists. Therefore, the creation of a variety of interactive electronic resources is necessary.

For this purpose, the creation of a wide range of interactive electronic resources is very important. As an example, we can show TV lessons "We play and learn" which were launched during the current epidemic, starting in 2020, with the financial support of UNICEF in our country.

The knowledge sector develops at the expense of innovation, along with scientific research and increasing the education of the population in the context of economic growth. It is just information and communication technologies (ICT) that create the conditions for innovation in both the growth of research and the level of education of the population. Economic growth and social development are conditioned by knowledge and education all over the world.

## LITERATURE REVIEW

The main task to ensure the transition to e-learning is the creation and effective use of a single electronic information learning environment based on ICT. The basis of the educational environment contains e-training resources provided by educational institutions and various manufacturing companies. Currently, training resources are created in different formats, based on different technologies and platforms, using different software devices [10].

The usage of these resources in the same environment can only be possible if they all support a common format and interconnectedness [8].

As an example, we can show smart education called flexible learning in an interactive learning environment with free access from anywhere in the world. Today, new technologies are applied to

the education system. One of them is cloud education technology. Since 2012, the United States, Australia, the United Kingdom, and Brazil began to implement large-scale e-learning projects. Online education courses interconnected many universities in the country in the education network [2].

Australia has also adopted a national e-learning management strategy for 2012–2015. Combining a single core database and suite of portals and apps for parents, students, and staff, iSAMS gives schools bespoke management of all academic, wellbeing, HR, administrative and financial information [10].

In Azerbaijan, at the beginning of the pandemic period from 2020, it was decided to conduct online training only at all levels of the education system, but no law has been adopted in this direction. In the study, the experience of Finland and China, South Korea, the United States, Australia, England, Brazil was analyzed. The results of their achievements in the higher education system are presented.

From social services Web 2.0 social service is included in the LMS (Electronic Management System) system. Web 2.0 is a second generation network service that operates on the Internet. Unlike the first generation services - Web1.0 services, they have a wide range of opportunities for sharing and exchanging information on Internet services. For instance, we can include Wikipedia, Google AdSense, Flickr, WordPress, and Blogger [3].

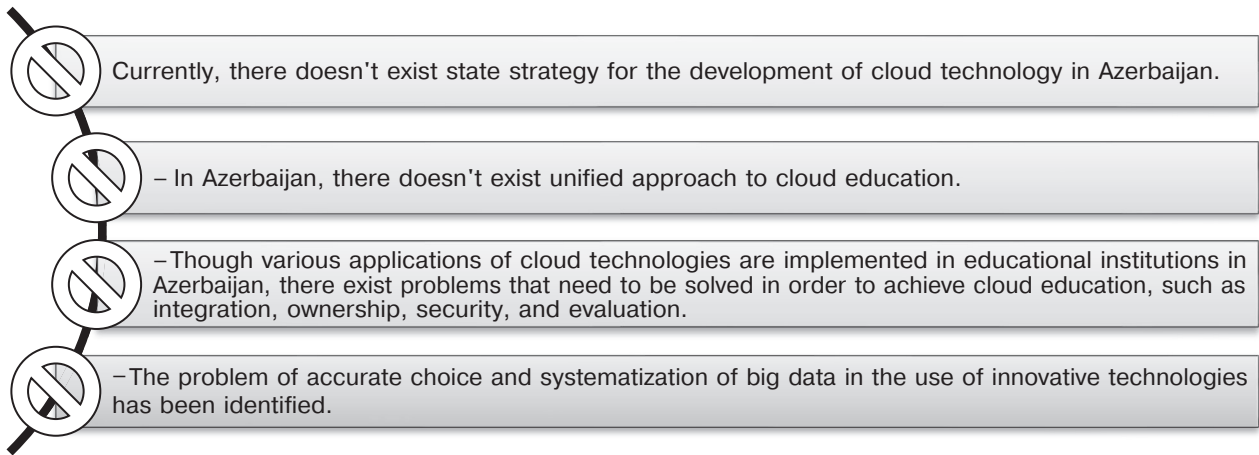
## PROBLEM AND METHODOLOGY

The problem of transition to the cloud and the impact of technological processes on the education system have been systematically studied in Azerbaijan. In conclusion, the results having theoretical and practical importance are shown as well as the conclusions and recommendations.

The article focuses on the transition to a cloud education system that aims to make the learning process more effective by transferring the educational process to an electronic environment. Widespread application of e-learning management systems in the education system and ways to improve the mechanism of using cloud technologies in the current pandemic period have been identified [2].

Research shows that the development of the education system based on information technology, as one of the main attributes of the knowledge economy, is a current requirement. One of the information technologies of the education system is the cloud system. The study shows the state position on the application of information technology in the field of education in Azerbaijan.

Though many countries around the world have already transferred to e-learning and use cloud government, but the issue of the importance of



**Fig. 4.** Problems in the development of electronic resources

**Source:** (Mazanova, O., Huseynova, A., (2019)) [3].

*Table 1*

**SWOT analysis**

Weak	Strong
Boring	Time saving
High quality education is not possible	Less finance
Negative effect of the monitor on the eyes	No travel expenses required
Does not provide real life experience	Jobs are easy to find
Supercomputer and high speed internet	Connection with world audiences

**Source:** author's work.

establishing this system in our country is reflected only in government programs.

The article the transition problem to cloud has been systematically investigated in the country, and discovered that extensive web resources and software for modern education are not widely used [11].

According to the analysis, the usage level of cloud resources by teachers and students in educational institutions was investigated and problems in the development of electronic resources were identified (**Fig. 4**).

Today, the transition to cloud is one of the important problems in higher education institutions operating in Azerbaijan.

Forecasting issues in the study were performed in MSExcel. Analysis methodology was used.

**ANALYSIS AND EVALUATION**

SWOT analysis was conducted accurately and comprehensively to evaluate the real situation in

the course of the research, to study and evaluate the development prospects.

According to evaluations, the transition to electronic systems and the strong and weak sides supporting these processes, existing opportunities, and threats have been identified. The effectiveness of the high level of electronic resource usage is estimated by factors such as time savings, reduction of transport costs, prevention of environmental pollution [2].

In the study, the issues related to the development of cloud training were investigated. Let's investigate SWOT analysis on the main features of training in the cloud (**Table 1**):

In the article, we prepared a survey to conduct research among university teachers on the transition to cloud training.

According to the survey, in 2022, 32 % of teachers prefer cloud training, 52 % hybrid training and 16 % traditional training (**Fig. 5**).

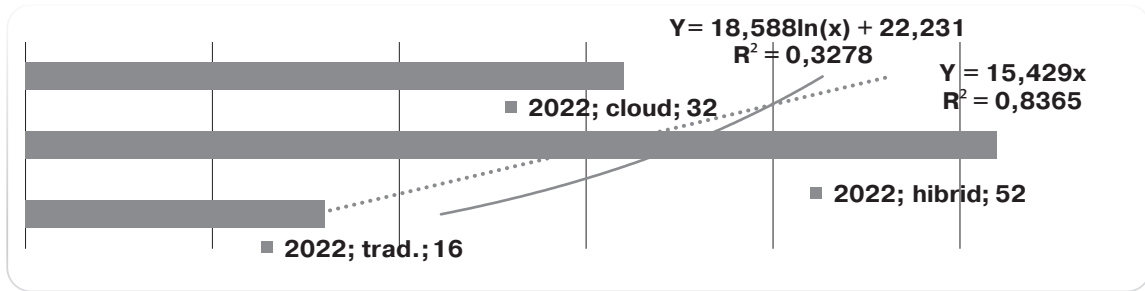
According to the survey, in 2021, 26 % of teachers preferred cloud training, 20 % hybrid training and 26 % traditional training (**Fig. 6**).

Let's make a comparative analysis of the teachers' advantages for cloud training in Azerbaijan in 2021 and 2022 (**Fig. 7**):

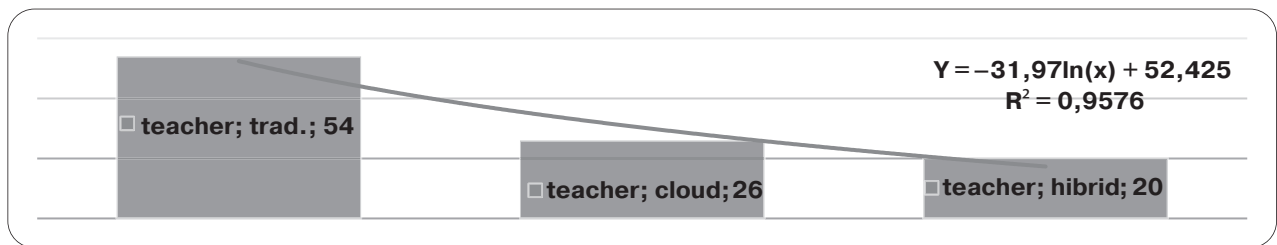
Although during the pandemic, in various countries in the world, both higher and secondary education institutions conducted training in the cloud, in the study, teachers responded to the survey based on their practical experience. In the study, we developed a table on the indicators dynamics of the cloud training benefits.

The table demonstrates the growth forecast for 2023–2024 according to indicator dynamics in Azerbaijan (**Table 2**).

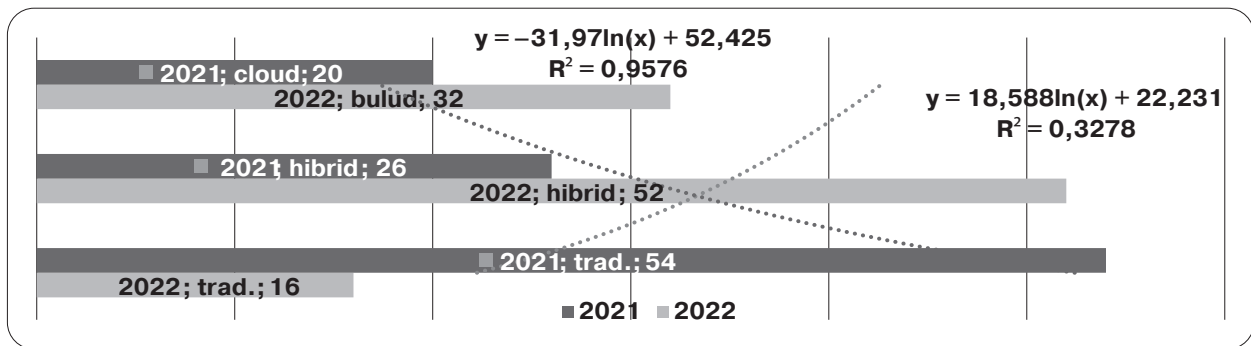
As seen from the table, considering the development of cloud training, we can say that there is



**Fig. 5.** The results of a survey of university teachers on the transition to cloud learning in 2022  
**Source:** author’s work.



**Fig. 6.** The results of a survey of university teachers on the transition to cloud learning in 2021  
**Source:** author’s work.



**Fig. 7.** Comparative analysis of the preferences of teachers for cloud learning in Azerbaijan in 2021–2022  
**Source:** author’s work.

a great need for expanded measures and propaganda work on the growth rate of the development index of cloud training (Fig. 8).

According to the results of the investigation, the development of cloud training in Azerbaijan is expected to increase from year to year.

**CONCLUSION AND RECOMMENDATION**

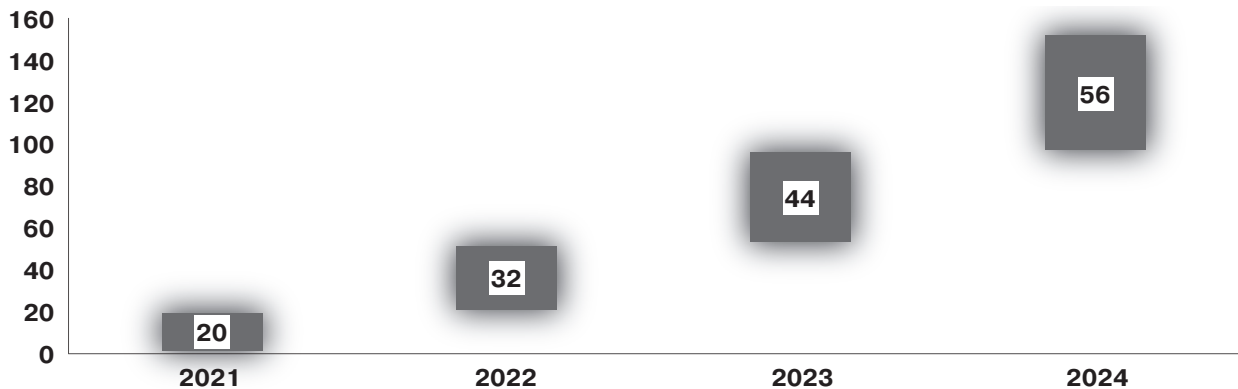
In the study, the current situation connected to these problems was analyzed and suggestions were made to eliminate the problem. Proposals for the current state based on analysis and assessments in the course of research:

Table 2

**2023–2024-years prognoz**

YEAR	YEAR		PROGNOZ			
	2021	2022	2023	2024	indicators dinamic	ROST
CLOUD	20	32	44	56		1,072853   1,093627

**Source:** author’s work.



**Fig. 8.** Teacher-2021–2022

**Source:** author's work.

- When analyzing the use of electronic means in the training process, we discovered a need for personnel being able to use cloud technologies.
- As a result of the research, we revealed that the usage level of electronic resources by the teaching staff is low.
- Representatives of the younger generation pay more attention to the use of modern innovations and cloud technologies in the education system. This is one of the most important factors affecting efficiency.

The state offers support for e-learning activities to provide e-standards for new generation technologies, to accelerate the technical work required to support broadband effective and other emerging technology systems, to develop comprehensive e-learning training methodological plans. Also, the establishment of an education system for e-learning is a significant factor for extending the national e-learning network. The cloud management system is more effective than traditional education. Here, students, teachers and other groups of people with financial difficulties can receive distance learning through the cloud management system to increase their knowledge and skills without leaving their places.

- The development of a state strategy to expand the use of cloud technologies in the education system of Azerbaijan was proposed.
- We have a need for expanded measures to increase the growth rate of the training index in the cloud.
- For achieving cloud education, we suggest solving the problems such as integration, ownership, security, and evaluation.

We suggest a unified approach to cloud education.

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## ПЕРСПЕКТИВИ РОЗВИТКУ ХМАРНИХ ТЕХНОЛОГІЙ У СИСТЕМІ ОСВІТИ В УМОВАХ ПАНДЕМІЇ

**Резюме.** У статті досліджено систему освіти як головний атрибут економіки знань, окреслено зміни в системі освіти Азербайджану. Автори пропонують розглянути приклади застосування інноваційних технологій у закладах вищої освіти зарубіжних країн у зв'язку з переходом від традиційної освіти до хмарної. У статті визначено фактори, що впливають на ефективність хмарної системи, а також важливість вивчення організації, економічних засад і принципів застосування систем управління електронним навчанням в освітніх закладах у методологічному теоретичному та практичному контексті. Продемонстровано економічний розвиток хмарних технологій і подано приклади з міжнародного досвіду змін у системі освіти.

**Ключові слова:** вища освіта, система освіти, хмарні технології, інноваційні технології, електронне тренування, інформаційні технології, електронне навчання.

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