Technologies and services in solving the problem of creating a common digital space of scientific and educational organizations

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Abstract. The article discusses conceptual approaches to the use of technologies and services for creating a common digital space for scientific and educational activities. The description of the basic processes is given taking into account the application of new approaches. The possibilities of the cognitive model of a participant in the scientific and educational process are considered.

1. Introduction
Consider one of the possible concepts for the formation of a common digital space of scientific and educational organizations. This concept provides a meaningful description of priority approaches in the field of transformation of basic processes for scientific and educational organizations (education, science, research and development). The concept ensures the transition to a qualitatively new level of decision-making, implementation of operational activities and achievement of results. Next, consider the conceptual description of the proposed solutions.

2. Basic technologies and services

2.1. Distributed ledger technologies
Distributed ledger is the term used to describe digital database technology that has different implementations in the ecosystem. An ecosystem can be considered a community of participants united by certain tasks, connections, functions, rules and communications [1,2]. A similar complexly organized system is a university with the implementation of basic processes, the main of which is educational. Consider the participants in the educational process at the same time as the stakeholders of the university. Suppose that each participant as an actor of certain actions and at the same time an interested party. Moreover, each participant in the educational process differs in a certain set of attributes and even competencies. As a result, it becomes possible to create a digital portrait of the participant as a set of data. The activity of people and devices (Internet of Things) in the digital space, including the Internet, generates "traces". Today, the stable term "digital traces" has come into use. This means that by gaining access to such information, it becomes possible to move on to personalization (targeting) of final
services, including educational ones.

Distributed ledger technologies, in addition to the accumulation and storage of data arrays, allow the implementation of smart contracts technology [3,4]. In essence, it is a computer algorithm designed to generate, control and provide information about ownership. For example, intellectual property or the achievement of cognitive results. Having unhindered access to the objects of the contract, the smart contract tracks the achievement or interruption of the clauses according to the specified conditions. After that, he makes independent decisions based on the programmed conditions. Thus, the main principle of a smart contract is complete automation and reliability of the execution of contractual relations.

A distributed ledger, as a medium, consists of nodes that use different data matching processes to achieve a common conclusion. According to the classification, distributed ledgers are of the following types: traditional, closed, controlled and open. The distributed ledger model can take into account the different order of entering and changing data. This requires an appropriate order of their approval. Thus, a distributed ledger can be completely controlled by one participant. In this case, it can be formed according to some collegial principle, taking into account the opinion of a larger number of participants.

Distributed ledger technology is the starting point for creating the digital space. First, it creates a platform of trust. Secondly, it endows the digital space with such functions as dynamism, immutability, security and decentralization. An additional advantage of using distributed ledger technologies is the low cost of ownership. Data will be stored in a decentralized manner, and will have the same value. Distributed ledger technologies are aimed at improving data reliability, reduction in operating costs, process optimization, elimination of duplication of work, increased transparency of work.

2.2. Cloud services
Cloud technologies and services based on them represent distributed computing power, with the possibility of balancing - allocating resources upon request or need.

A traditional cloud-based service is a data storage. Which also provides universal accessibility to data across devices and geographic locations. Modern cloud services provide reliable data storage and scalable computing. In addition, they are able to provide analytical information through flexible custom tools. Analytical data requires visualization and presentation preparation. Cloud services make it possible to customize analytical dashboards with charts, tables and other visualization options over various sources, including in real time. This increases the efficiency and reliability of the data, which is necessary for the decision makers.

A person and a device can act as the sources necessary for the formation of a dataset. In the modern digital world, including the world of the Internet of things, the dynamic growth of data is carried out from digital data sources, which form the so-called Big Data. At the same time, a separate category of digital services stands out - end-to-end services, without human participation - machine to machine / device to device.

Some of the data is visual - images of text information or images of faces. Thus, services based on machine learning methods become actually.

The service approach is aimed at ensuring the solution of repetitive tasks, where the participants and the algorithm of actions are clearly defined. Also aimed at increasing the automation of processes in general. Today universities are implementing many processes, most of which are clearly regulated and a service approach can be applied to many of them. A cloud-based service approach provides a common window for the end user (process participant).

2.3. Virtual and augmented reality
Today we are witnessing a high growth of technologies, which in turn are being introduced in the manufacturing sector. This requires educational institutions to move synchronously in the field of mastering and broadcasting modern production technologies in educational programs. At the same time, the material and technical support for the implementation of educational programs, especially a technical profile, also requires an actual update.

In a competitive environment for resources in which educational institutions are located, it is not
possible to promptly update the material and technical base (educational, practical and laboratory stands) for up-to-date technological and production solutions. One of the solutions to this problem is to create a simulation environment for the support of the educational process. Firstly, when implementing laboratory and practical courses, secondly, lectures, in general, contributing to an increase in the perception of the materials being studied. Virtual and augmented reality technologies contribute to the introduction of new educational approaches. This is reflected in the cognitive model of the student. This changes the concept of the formation of the material and technical base, focuses on the design and development of simulation environments of increased perception [5]. Thus, computer classes with applied software are being replaced by software and hardware complexes of virtual and augmented reality.

Another important factor in favor of the development of imitation environments of increased perception with virtual and augmented reality technologies is the virtual implementation of production and technological processes of especially complex and hazardous industries.

3. Results of basic processes transformation

The modern approach to representing the university is associated with the allocation of the so-called basic processes. These are the main activities requiring operational, financial, economic and regulatory support. At the same time, provided by stakeholders and built into the system of assessment, ranking, rating, etc. If the basic processes are able to transform and be sufficiently "flexible" in the existing dynamic market environment, the more stable the position of the university as a whole. Let's highlight the main basic processes for the university and consider the possible applicability of the presented technologies.

3.1. Educational activities

In educational activities, the term student's cognitive model is used today. This reflects a personalized approach to mastering the educational program. To implement such an approach, a certain transformation of a number of supporting processes is required. The starting point in the implementation of this approach is the collection and analysis of information.

The cognitive model is based on the applicant's attributive portrait. This is the input data on the level of training, the development of additional educational programs and the portfolio as a whole. At the same time, the data can be received both from the institutions of the partner network, and from a call to the cloud PBX, with information about the preferred direction for receipt. Thus, the level and amount of input information can be different, but at the same time it is available for aggregation and subsequent analysis.

Data analysis enables the development of student profiles, reflecting the necessary information expressed in modules (disciplines). Profiles can be supplemented with continuing education courses, networking programs, online courses, massive open online courses, foreign language courses, etc. Additionally, information can be generated about participation in student projects, research work, volunteer movement, sports life of the university, etc.

Today, mobile technologies are an accessible format for presentation and a tool for the subsequent development of an educational program in accordance with the student's profile. At the same time, cloud services are effective solutions for ensuring mobility.

Some of them include providing access to educational course materials. Which can be built using augmented reality technologies, work with data sources (finding and recognition of text, translation from foreign languages), voice assistants, etc. The service approach also affects the infrastructure aspect. With the help of mobile solutions, we will resolve the issue of student identification (library, dormitory, gym, etc.)

Control of the process of mastering the educational program goes into the plane of a smart contract in the digital space of the distributed ledger. The resulting condition of the smart contract is the receipt of a diploma on the assignment of a qualification (degree). In the plane of the distributed ledger, this is just additional information about the participant in the digital space. But for the university, this is
knowledge information, since all subsequent stages of the student's professional trajectory will be reflected in this digital space. New members acting as employers will be able to both receive and provide additional information. Firstly, get analytics of mastering of the educational program by students, and secondly, become a source of data on advanced training, assignment of a category, etc.

An important aspect of the distributed ledger-based digital space is the order in which data is reconciled and transactions are completed. For example, the completion of the development of an educational program, as a complex condition of a smart contract, requires the approval of the participants of the distributed register. One of which, for example, is the employer, who, in turn, must be involved in this process in order to make the appropriate decision. Thus, using the educational process as an example, distributed ledger technologies also make it possible to form a professional community of participants with expressed expert opinion. It also helps to create a platform for organizing other forms of interaction, for example, alumni associations.

The introduction of the above technologies and solutions allows us to move on to the design and implementation of the cognitive model of the student: provide end-to-end services aimed at reducing the bureaucracy of the processes being implemented; create a digital data platform and move to a smart contract mechanism.

At the same time, the presented service model is impossible to fully provide on its own. Thus, it becomes necessary to connect to third-party, already functioning cloud services, on the terms of outsourcing.

3.2. Scientific activity
Consider the scientific activity of the university as a basic process. Let us single out the following set of areas related to the training of highly qualified personnel, the development of student research work, the formation of a network of student scientific communities, the organization and holding of conferences at various levels, the formation of scientometric information. These directions are not strongly affected by market conditions, however, they also require flexibility and modification, which characterizes the transformation of the process as a whole.

In terms of training highly qualified personnel, this is an analysis and identification of potential applicants for a scientific degree based on the accumulated metadata in the digital space of the university.

Development of services aimed at preparing dissertation materials (literary reviews), selection of thematic materials, recognition of texts on scanned pages of documents, checking for anti-plagiarism, selection of conferences for testing hypotheses and theories.

Generation of a new format for holding conferences and seminars in the digital space in order to expand the audience of listeners, including an international audience, provided with cloud services for simultaneous translation, visualization of poster presentations with augmented reality technologies.

To generate new knowledge in the environment of student scientific communities, it is possible to create channels for the dissemination of information with a thematic collection of news about world scientific developments and developments of the university.

Possible services are - connection to external data sources related to participation in conferences, including international; connection to scientometric databases, to obtain operational information on the results of publication and citation, to obtain information on metrics, to ensure verification of the information provided.

A separate service can be the selection of thematic journals, including those differing in scientometric bases and quartiles, for the publication of scientific works of scientists, based on personalized analytical data about university scientists.

3.3. Research and development
Research activity always has a customer, either in the person of a university or an external. Thus, the execution of an order requires resources, including intellectual (human), financial, material and intangible, as well as control over the implementation of stages of work. All this in most cases fits into the design logic. Improving efficiency, project management is associated with the development and
implementation of project support tools. Which are based on cloud services with the ability to track the implementation of projects in real time, record labor costs, estimate pricing.

Development of cloud services for teamwork - the implementation of collaboration, both internal and external. These are services for conducting webinars, virtual platforms for conducting joint experiments, or means of broadcasting them, joint editing of documents, etc.

Creation at the university of a digital platform of its own developments for the management of intellectual property, with built-in tools for assessing intellectual property, organizing patent search. Combining intellectual resources into a common digital platform of the university, provided with cloud services, will allow the transition to collective intelligence technologies (Data IQ) with the ability to generate knowledge (Data mining).

3.4. Digital university model

Designing a digital university is creating a model of a space of opportunities in the field of information culture [6,7].

The digital university model assumes a tiered structure and an encapsulated construction principle (figure 1). The initial basic level is the physical infrastructure - computing power, networks and communications, sources of various data, technical means of augmented and virtual reality. The next level is advanced technologies, the introduction of which allows you to move to new forms of interaction between participants in the basic processes of the university.

![Cognitive Model of the Students](image)

**Figure 1.** Implementation of the cognitive model of the students.

Among them, the most relevant are distributed ledger and artificial intelligence technologies. Based on the presented technologies, services are deployed as mechanisms to ensure the basic processes of the
university, and work with content, a digital knowledge base of the university. Thus, two environments (physical and mobile) are clearly formed as tools for the implementation of the basic processes of the university. In the first case, it is a traditional environment, improved by modern technological solutions, in the second case, it is a completely mobile personalized space.

As an example (figure 1) of the implementation of the student's cognitive model, the following route according to the model is possible: to increase the efficiency of mastering the educational program, the student can be formed a "digital proposal". This is an individual student profile based on a neural network analysis of the student's portfolio, his current academic performance, a selection of both university content materials for study, and tools (solutions) for mastering the course, including mobile.

4. Conclusion
Thus, a model of an intelligent decision support system is formed for stakeholders, the main of whom are students, for whom "digital" increases the availability of knowledge and helps to make responsible decisions.

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