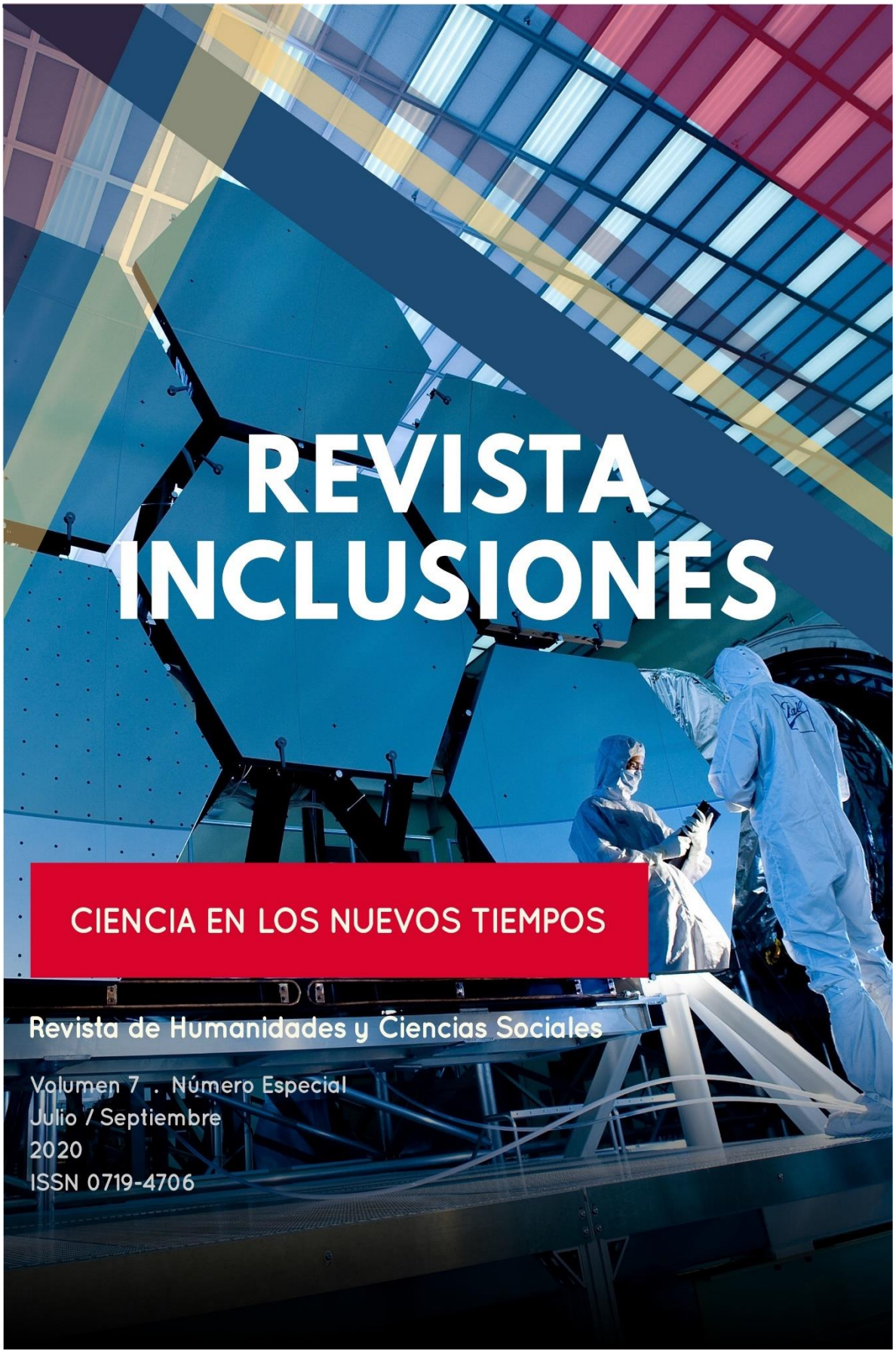

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BUSINESS EDUCATION: TRAINING IN THE USE OF BLOCKCHAIN TECHNOLOGY FOR BUSINESS DEVELOPMENT

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Abstract

The rapid development of information technologies, the hybridity of modern cyber threats and vulnerabilities, and the failure of traditional cryptosystems to resist cyber-attacks require the use of new approaches to form a secure business process contour. One of these approaches is the formation of decentralized systems based on blockchain technology, which is rapidly spreading in various sectors of society. The basic principle that underlies it is the peer-to-peer privileges of all users of such systems based on cryptographic digital signature protocols and hashing. These, as well as other advantages and properties of blockchain technologies, ensure their spread and the rapid spread of decentralized systems using cryptocurrencies. Based on an expert survey, the main provisions of the "Blockchain: Fundamentals and Application Examples" business education course have been developed, the competencies and learning outcomes for this course have been determined, and the sample business program "Blockchain: Fundamentals and Application Examples" has been presented.

Keywords

Blockchain – Blockchain technologies – Blockchain system – Cryptocurrency – Bitcoin – Token

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Introduction

Modern humanity is on the threshold of global digital transformations[1]. High research and development costs from leading IT companies encourage the creation of original proprietary solutions[2]. The introduction of 5G telecommunications technology in the next decade will provide the expected innovative solutions for the security, scalability, and performance of global networks and connections in all areas of activity[3]. Digital humanity – digitized humanity – involves accurate digital identification of the individual based on natural biometric parameters (fingerprints, facial scans, eyes, and DNA), which will exclude paper media, plastic cards, certificates, diplomas, and passports on a planetary scale. A digital identifier makes it possible to delegate the positioning of each person in time and space of the cloud service, which removes all problems associated with the cyber-physical analysis of illegitimate actions of each individual[4]. The consequence of the sustainable development of digital humanity within the Internet of things (IoT) to create a smart world[5] is a multibillion-dollar cost saving on the production and use of paper documents, as well as conservation of forests and planetary ecology. The smart world provides every person with services from smart devices (watches, mobile phones, computers), smart transport, smart infrastructure, and smart digital education.

The world without intermediaries is an innovative technological way of direct telecommunications contacts of every person with any subject on the planet due to the use of cyber-physical services. All this humanity will be able to do with the help of blockchain technology – a decentralized cryptographic transparent technology for storing and exchanging data about completed transactions, which provides direct interaction between businesses or entities without trusted legal intermediaries within the IoT service[6]. However, without the legitimate recognition of blockchain by government agencies, this technology is still a resource-intensive experimental enclave in the cyberspace of data and legalized transactions[7].

Blockchain technology rejects all intermediaries – bankers, a multi-million-dollar army of government officials – when making a transaction between two parties. The third-party – intermediary – is always redundant, which reduces the profits of business producers,

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[1] G. M. Gogiberidze; V. A. Isakov; T. V. Ershova y O. V. Shulgina, “Development of Innovations in the Educational Environment: Inclusive Education and Digital Technologies”, Revista Inclusiones Vol: 7 (2020): 147-158.

[2] F. A. Zueva; M. Zh. Simonova; S. G. Levina; I. A. Kilmasova y I. N. Likhoumova, “Basics of Production as a System-Forming Component of Professional Training of a Modern Teacher of Natural Scientific and Technological Cycles”, Revista Inclusiones Vol: 7 (2020): 334-341 y G. T. Glembotskaya; S. Yu. Eremin y E. E. Chupandina, “Scientific Priorities and Real Prospects for Cost Optimization in Formulation Development”, Entrepreneurship and Sustainability Issues Vol: 7 num 3 (2020): 1484-1499.

[3] S. Makridakis, “The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms”, Futures Vol: 90 (2017): 46–60.

[4] T. N. Dinh; M. T. Thai, “AI, and Blockchain: A Disruptive Integration”, Computer Vol: 51 (2018): 48–53.

[5] L. Atzori; A. Iera y G. Morabito, “The internet of things: a survey”, Computer Networks Vol: 54 num 15 (2010): 2787–2805.

[6] D. Miorandi; S. Sicari; F. D. Pellegrini y I. Chlamtac, “Internet of things: vision, applications, and research challenges”, Ad Hoc Networks Vol: 10 num 7 (2012): 1497–1516.

[7] V. Yu. Viktorov; E. V. Luneva; O. S. Malysheva y O. N. Pogodina, “Economic and Social Processes in Education: Development of Universities in the Context of International Trends”, Revista Inclusiones Vol: 7 (2020): 72-84.

complicates transactions, and, most importantly, is the only source of corruption on the planet. Blockchain technology (in particular, bitcoin) is a cyber-physical metric cloud cryptographic computing for transparent monitoring and trust management of transactions in distributed blockchain data[8].

The most famous application of the blockchain is the bitcoin cryptocurrency, but many companies and researchers offer other opportunities to use this technology. According to A. De Vries, it is expected that it will be possible to store 10% of the world's GDP by 2027 based on blockchain technology[9].

In 2009, S. Nakamoto unveiled the first digital currency. The technology worked on the principle that money is a tool for accounting and abstracting the cost of goods and services during operations. Money is the historical metric intermediary for the equivalent exchange of goods and services. Possession of physical bills or coins is equivalent to possession of tangible goods or services. If instead of banknotes one creates a table of participants in a closed community, where each person's accounts will be registered, then the need for physical money will disappear. The banking sector has already partially transformed physical money into the digital record of the transaction processing. Bitcoin completed the transformation by creating a universal digital ledger, the so-called blockchain, where changes can only be made by adding a new entry to the end of the blockchain. The bitcoin blockchain is replicated on network computers and is available to each network member. A class of network participants called miners is responsible for detecting transaction requests, verifying them, and adding new blocks to the blockchain. Validation checks the validity of a buyer who owns bitcoins in their transaction. Ownership in the blockchain chain of bitcoins is determined by a pair of cryptographic keys – public and private. The public key is stored in the blockchain for all participants, and the private key is kept safe by the owner. The two keys are in a special mathematical relationship that makes them useful for digitally signing transactions[10].

According to A. Zohar, bitcoin was created as an independent technology for assessing the social significance of people's performance, directed against the injustice and corruption of the traditional financial system. The growing social significance of the parallel currency creates serious competition for intermediary and financial institutions. The thesis "in cryptography we trust" leaves no room for various intermediaries who significantly slow down all the processes of human activity, reducing profits and complicating transactions[11].

M. Crosby notes that bitcoin replaces the services provided by intermediaries today with cryptography and executable code. Bitcoin and other cryptocurrencies replace contractual agreements with banks and other people with a distributed and secure database called a blockchain. The verification process, through which ownership of a bitcoin token will pass from one person to another, is entrusted to a network of computers[12].

[8] M. Nofer; P. Gomber; O. Hinz y D. Schiereck, “Blockchain. Business & Information Systems”, Engineering Vol: 59 num 3 (2017): 183–187.
[9] A. de Vries. Bitcoin's Growing Energy Problem. Joule Vol: 2 num 5 (2018): 801–805.
[10] R. Böhme; N. Christi; B. Edelman y T. Moore, “Bitcoin: Economics, Technology, and Governance”, Journal of Economic Perspectives Vol: 29 num 2 (2015): 213-238.
[11] A. Zohar. Bitcoin: Under the Hood. Communications of the ACM Vol: 58 num 9 (2015): 104–113.
[12] M. Crosby; P. Pattanayak; S. Verma y V. Kalyanaraman, “Blockchain Tech-Nology: Beyond Bitcoin”, Applied Innovation Vol: 2. (2016): 6-10.

According to R. Dennis, the scope of blockchain technology is cyber-physical processes and phenomena affected by corruption due to the presence of intermediaries who cannot be truly trusted. It is possible and necessary to build blockchain-based trust systems for open management of science, education, tourism, transport, finance, society, medicine, and human resources[13].

Researchers believe that the blockchain system can be useful much more than just monetary relations without intermediaries. After a successful bitcoin debut, researchers began to generate other market-oriented applications on the blockchain platform. When miners verify transactions, they run small programs that process the data and provide "yes-no" expert opinion on the transaction request. They can run more complex programs, such as social networks and online forums, and manage social groups and states[14].

According to Indian scientists M. Iansiti and K. Lakhani, today after creating the first blockchain in the form of cryptocurrency, people successfully apply it to social processes and phenomena where it is possible to replace intermediaries with a blockchain. In their opinion, it is possible to offer thousands of projects to replace expensive intermediaries between the seller and the buyer of goods and services with blockchain: to offer directly entertainment, travel, attractions, television, movies, concerts, sports competitions, transport tickets. At the same time, there will be no room not only for banks but also for services such as Uber and Netflix[15].

In 2017, the report "Blockchain in Education" was published, which presented the fundamental principles of the blockchain, focusing on its potential for the education sector. This report explains how this technology can violate institutional norms and empower students. It also offers eight scenarios for applying blockchain in the context of education, based on the current state of technology development and deployment. According to the report, blockchain technologies will reduce the cost of issuing certificates if paper certificates are no longer issued. Assuming that other evaluations and accounting costs are similar, they will make it more practical to issue certificates for micro-loans, that is, they will be able to certify individual courses, modules, or other learning outcomes without any additional costs in terms of issuing certificates (printing and administrative costs associated with certificate verification)[16].

The leaders of the IT industry also play on the side of blockchain. Today, blockchain technology is steadily developing as a distributed trust computing in space and time: Microsoft's blockchain applications in the Azure cloud. IBM supports the open-source blockchain in the Hyperledger project, which aims to create architectures for business-oriented blockchains[17].

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[13] R. Dennis y G. Owen. Rep on the block: A next generation reputation system based on the blockchain. Proceedings of the 10th International Conference for Internet Technology and Secured Transactions (ICITST). London. 2015. 131–138.

[14] H. Jin; X. Dai y J. Xiao, Towards a novel architecture for enabling interoperability amongst multiple blockchains. Proceedings of the IEEE 38th International Conference on Distributed Computing Systems (ICDCS). Vienna. 2018, 1203–1211.

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[16] A. Grech y A. F. Camilleri, Blockchain in Education (Luxembourg: Publications Office of the European Union, 2017).

[17] H. Min, “Blockchain technology for enhancing supply chain resilience”, Business Horizons Vol: 62 (2019): 35–45.

Meanwhile, many of the largest banks have created their version of the blockchain, trying to lead the successful development and promotion of the technology. However, blockchain projects have not yet revolutionized any industry, as its creators would like. According to researchers, the cryptocurrency is used in a community consisting of 375,000 people with an integrated level of crypto space capitalization, exactly 400 billion dollars. However, investor dollars invariably rise in price, and the masses of new proposals arise from an inexhaustible source of blockchain, most of which are not yet perceived by the business and the scientific community as the uncontested future[18].

D. Kraft refers to the disadvantages of blockchain computing the following: 1) multiple duplications of data in a distributed network; 2) the openness of valuable data, patents, and codes, which will destroy some companies; 3) high costs for creating an infrastructure focused on the blockchain; 4) fierce resistance of government structures to the introduction of such a system of resource allocation[19].

Currently, a blockchain worldview is gradually emerging from various postulates and definitions:

1) Cryptocurrencies can compete with national currencies and peacefully seize financial, political, economic, and legislative power totally or in separate segments of human activity. At the same time, each social group that has common interests can create its cryptocurrency to exchange certain goods and services without using external currencies[20].

2) Barter relations within a closed social group: "you – to me, me – to you" are a physical prototype of cryptocurrency hidden from society without the use of standard banknotes, and the issue of securities and shares by a company is equivalent to the issue of tokens, cryptocurrencies, and bitcoin[21].

3) The positivism of creating temporary blockchain networks is the exclusion of any intermediaries in concluding reasonable contracts between members of a closed community. Intermediaries are government agencies, private organizations, banks, and officials who produce goods and services that significantly increase the overhead cost of doing business[22].

4) The existence of a metric (cryptocurrency) for measuring the social significance of goods and services in a closed network of users is a condition for its existence[23].

[18] F. Hawlitschek; B. Notheisen y T. Teubner, “The Limits of Trust-Free Systems: A Literature Review on Blockchain Technology and Trust in the Sharing Economy”, Electronic Commerce Research and Applications Vol: 29 (2018): 50-63.

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[22] K. Christidis y M. Devetsikiotis, Blockchains and smart...

[23] B. Bodó; D. J. Gervais y J. P. Quintais, “Blockchain and smart contracts: the missing link in copyright licensing?”, International Journal of Law and Information Technology Vol 26 num 4 (2018): 311-336.

5) The blockchain network, as a system, aims to improve the quality of life and preserve the ecology of the planet through moral human-free management of social processes without intermediaries to distribute remuneration based on exhaustive monitoring of social significance and verified transactions, as well as intellectual contracts[24].

6) The blockchain network is scaled into a cyber state, where the subjects are companies and organizations that distribute taxpayer money by consensus without intermediaries. The cyber state receives a part of the profit from the subjects for the development and maintenance of the life of the social system[25].

7) A smart contract (intellectual contract) is a cyber-social system of electronic intermediary human-free relations between a buyer and a seller of goods and services implemented in the form of a crypto-protected program code, which aims to reliably fulfill the contractual conditions by the parties based on exhaustive monitoring of the process of fulfilling obligations and developing adequate impacts on the components of the blockchain infrastructure[26].

8) Blockchain computing is a computing process in a closed distributed cyber-social temporary computer network designed to fulfill intellectual contracts and preserve the replication of crypto-protected chains of transaction records based on human-free monitoring and consensus validation of each new block to create tolerant trust relationships, without intermediaries between unreliable network participants[27].

The purpose of the article is to analyze the possibilities of business education in teaching the use of blockchain technology for business development.

Research hypothesis: the growing demand for qualified specialists in the field of blockchain technology application due to the rapid development of this industry makes it necessary to develop a course of business education in this area of activity.

Based on the results of the study, it can be concluded that the goal set in the study was achieved.

Methods

A set of theoretical and empirical methods was used in the research. Theoretical methods, such as the analysis of monographs, articles, and specialized literature on the problem of research, were used.

From the empirical methods, an expert online survey was used, aimed at developing the main provisions of the business course "Blockchain: Fundamentals and Application

[24] V. L. Lemieux, “Trusting Records: Is Blockchain Technology the Answer?”, Records Management Journal Vol: 26 num 2 (2016): 110-139.

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[27] M. Vukoli´c, The quest for scalable blockchain fabric: Proof-of-work vs. BFT replication. In International Workshop on Open Problems in Network Security (Zurich, Switzerland, 2015), 112–125.

Examples", determining its competencies and learning outcomes, and presenting its approximate curriculum.

The expert online survey was attended by 50 experts – university professors and employees of IT companies.

Results

Based on the expert survey, the main provisions of the business educational course "Blockchain: Fundamentals and Application Examples" were developed, which provides two content modules and two modular test papers.

This course is designed to familiarize students with blockchain technology, which allows transferring and storing digital assets in a decentralized way. The course explains the main components of the blockchain, such as transaction, block, block header, and blockchain, as well as blockchain operations, such as verification, validation, and consensus-building. In this course, students gain an understanding and knowledge of the basic concepts of blockchain technology, learn how to develop decentralized applications for blockchain networks, and gain skills for developing and implementing smart contracts.

The object of the course is blockchain technology and activities related to it. The subject of the course is theoretical concepts, principles of functioning, and application of blockchain technologies.

The purpose of the training course: mastering the theoretical foundations, forming a holistic view of the essence of blockchain technology and the advantages of its use in information systems, and developing skills in using blockchain technologies, economic relations based on cryptocurrencies, and smart contracts.

The main objectives of the course are:

- to learn the principles and rules of using cryptographic methods in blockchain technologies;

- to learn the methodological basis for the development and operation of blockchain platforms;

- to acquire real-world capabilities for using cryptocurrencies and functioning of smart contracts;

- to master effective means of limiting the risks of creating and using cryptocurrencies, using smart contracts.

Based on an expert survey, the competencies and learning outcomes of the course were determined (Table 1).

No.	Competencies	Learning outcomes	%*
1	Ability to use ICT to search for new information, create databases, analyze distributed speakers, communication channels, process control systems, databases, operational planning of systems based on the analysis of information flows and their optimization	Design future professional activities considering their significance for the citizen and the state, as well as the directions of development of information and cybersecurity	90%
		Carry out professional activities based on knowledge of modern ICT	85%
		Apply software tools, work skills in telecommunications and computer networks	80%
		Use specialized computer programs in professional activities	80%
		Select the appropriate programming technology and perform task specification analysis	75%
		Perform software analysis to find, identify, detect, and resolve programming errors	70%
2	Ability to solve specialized tasks and practical problems of using blockchain technology in various sectors of the economy	Have a comprehensive understanding of what blockchain technology is and how it works; identify key roles and players affected by this technology	85%
		Take part in the development and implementation of information systems, databases, data warehouses, and data spaces based on blockchain technology	80%
		Be able to use various platforms based on blockchain technology in business processes	75%
		Use smart contracts and track their execution	70%
		Plan and forecast the use of blockchain technologies in various spheres of life	70%
		Use cryptocurrency within the current legal framework	65%

Note: compiled based on the expert survey; * – percentage of expert mentions

Table 1

Competencies and learning outcomes for the course "Blockchain: Fundamentals and Application Examples"

Table 2 presents an exemplary program for the training course.

No.	Topic	
Content module 1. Basics of using cryptographic methods in blockchain technology		
1	Topic 1. Trust and vulnerability	1.1. A brief history of scaling human trust
		1.2. High and low trust societies
		1.3. Trust model types: Peer-to-Peer, Leviathan, and Intermediary
2	Topic 2. Basic cryptography	2.1. Basic cryptography
		2.2. Fundamentals of cryptosystems of traditional cryptography
		2.3. Basics of public-key cryptosystems
		2.4. Basics of a digital signature. Hash functions
3	Topic 3. Use of cryptography in the blockchain	3.1. Fundamentals of decentralized systems
		3.2. Use of hash functions in blockchain technology
		3.3. Digital signatures for signing transactions
4	Topic 4. Blockchain technology, its features and limitations	4.1. Content of blockchain technology. Special transaction types
		4.2. Limitations of blockchain technology, its types (public and private)
		4.3. Differences in approaches to achieving consensus
		4.4. Principles of system security analysis
Content module 2. Features and examples of using blockchain technology		
5	Topic 5. Implementation of blockchain in bitcoin	5.1. History of bitcoin's origin and development stages
		5.2. Bitcoin as a payment system

		5.3. Bitcoin economy: features of its use at the present stage
6	Topic 6. Blockchain as a platform	6.1. Safe time stamping: features of application and implementation
		6.2. Practical application of the properties of bitcoin
		6.3. Essence of the forecast market and analysis of the possibility of building it based on bitcoin
7	Topic 7. Smart contracts	7.1. Fundamentals of contract law. Smart contracts and their potential
		7.2. Credibility of the impact of the algorithm on society. How can existing legal systems be integrated?
		7.3. Writing smart contracts
8	Topic 8. Non-financial examples of using blockchain technology	8.1. Copyright protection, digital assets, and tokenization
		8.2. IoT and the use of blockchain technology in it
		8.3. Electronic voting

Note: compiled based on the expert survey

Table 2

"Blockchain: Fundamentals and Application Examples"

Discussion

Currently, blockchain is one of the fastest-growing industries. Accordingly, the demand for qualified specialists in this field is growing. Cornell Blockchain and University College London were among the first to introduce blockchain technologies to the curriculum. Cornell Blockchain provides a real experience of linking business and technology. Training at University College London includes regular lectures and seminars conducted by leading experts[28].

It is worth mentioning the Institute for Blockchain Studies, an independent institution that studies the social consequences of blockchain technology. This project was developed by M. Swan, an MBA graduate in finance from the University of Pennsylvania's Wharton Business School. During the training, students gain knowledge about blockchain technology. The lectures discuss the current state and potential applications of blockchain in finance, logistics, healthcare, energy, etc[29].

The project to create an online learning platform for BitDegree is also worth noting. It is planned that the payment will be provided directly by future employers. The BitDegree BDG token will be used for interaction between participants on the platform itself, as well as sponsors or third parties, and BDG tokens have a guaranteed fixed exchange rate. The company offers guarantees for participants to be sure of the value of their tokens while the value of BDG is guaranteed by Hostinger. Hostinger promises to accept BDG at their cost, in exchange for the equivalent cost of web hosting services, and the exchange rate is fixed for the first year. The BDG token is the basis for the development and operation of the BitDegree project, which creates an effective and secure economic system of the BitDegree platform based on blockchain technology. Smart contracts and decentralized blockchain technologies allow coordinating the incentives of students, content creators, and employers. Decentralization allows creating an online community that allows students and teachers to interact freely without intermediaries. Blockchain technology eliminates the need for employers to use expensive recruitment companies to get the best experts in the field of its technology. The BitDegree project won the Moonchise 2017 competition. In turn, Moontec

[28] P. M. Devine, Blockchain learning: can crypto-currency methods be appropriated to enhance online learning? Proceedings of the ALT Online Winter Conference (2015), 7-10.

[29] G. R. White, “Future applications of blockchain in business and management: A Delphi study”, Strategic Change Vol: 26 num 5 (2017): 439-451.

17 is the largest conference in Northern Europe dedicated to blockchain technology and its implementation in various industries[30].

The Faculty of Economics of the Moscow State University also introduced a course in the master's curriculum, which examines issues related to the blockchain. The University holds open expert seminars on the problem of cryptocurrencies. Since 2017, in October-December, Moscow State University's Department of Economics has been conducting a 2-month Blockchain Founder program for beginners and developers of blockchain projects, whose participants study the technical aspects and business application of blockchain.

Conclusion

The importance of blockchain technology in the world is increasing every day. The most important factor in promoting blockchain technology is the state's commitment to the formation of a digital society.

Blockchain technology is certainly one of the key tools for building the future digital economy. It creates the very foundation for the emergence of new economic relations, establishes trust, and turns reputation and professional skills into a manageable attribute that can be used for the interaction of each person or organization with other market participants. This allows offering digital contracts safely and efficiently, and the production processes themselves are accelerated by eliminating manual work and paper workflow, which increases the speed and significantly reduces the cost of all transactions.

The results of the study confirmed the hypothesis that the growing demand for qualified specialists in the application of blockchain technologies due to the rapid development of this industry necessitates the development of a business education course in this area of activity.

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