

Usage of Blockchain Technology for the Improvement of Industry and The Training of Future Talents

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Abstract— This study presents a systematic review using the Kitchenham method, to analyze recent research works related to blockchain technology and its application in training. The problems of exchanging data safely and rapidly with transparency and centralization, led to the emergence of this technology that has revolutionized the world and in almost all areas. Different articles are devoted to show the various approaches, equipped, methods, skills, knowledge, etc., necessary to the application of the blockchain. The main objective of this study is to reveal the importance of this technology for the development of industrial and educational world showing different skills, competencies, talents required to implement a blockchain, and use it for management and education.

Keywords- blockchain; training; skills; competencies.

I. INTRODUCTION

The lack of confidence and dissatisfaction with third parties and traditional mediators, institutions, banks and states, led to the creation of many research challenges in different fields such as: technology, economy, politics and sociology [23]. To face this problem, researches are directed towards blockchain technology i.e. a technology for storing and transmitting information, allowing the constitution of replicated and distributed registers, without a central controlling institution, with a high degree of security, thanks to encryption methods and transmission protocols [16]. It is structured by blocks linked to each other, at regular time intervals [24]. Researchers consider the blockchain as a double-edged sword technology; it has been considered the safest peer-to-peer system [15]. Schematically, the necessary environment for the implementation of a blockchain can resemble to a 4 layers structure (Fig.1) [19].

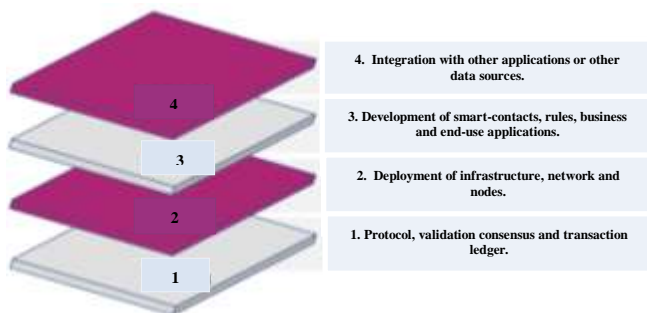


Figure 1. The blockchain structure [19]

Nowadays, researchers are very interested by blockchain technology, with its integration in all fields (Fig. 2) [17]. In order to catch up the fast-paced development of industrial

technologies, which requires adaptation to the evolution of the world and the development of interaction with other disciplines and new approaches, therefore it is essential to align the supply of skills with the fast changing of economic needs. This requires sound education policies as well as transformation of education and training systems, as there are signs that educational institutions are not keeping pace with technological advancement, leading to skills shortages [18].



Figure 2. Applications of the blockchain technology [17]

Fifteen articles are used, through a systematic review, using the Kitchenham method [21], a manual division of the articles throughout the reading presented in the diagram (Fig. 3). We choose as criteria: the field of application (education, industry) and application methods (analytical, practical). Section 2 of this article is devoted to detailing the 15 articles, where we will provide an overview of the use of blockchain technology, to improve teaching process, and ensure mastery of the technology and training talent. Section 3 concerns the digitizing the human resources area in industry thanks to blockchain technology. We will finish by a conclusion.

II. EDUCATION AND TRAINING FACE THE BLOCKCHAIN TECHNOLOGY

According to reports published recently through web sites, the blockchain will be the most demanded skill by employers and these profiles are highly demanded [25]. To meet the needs of employers and understand the challenges of this technology, universities have adopted special blockchain training techniques to attract the attention of students, and to achieve the desired skills to master the difficulties of this technology to improve the teaching process. Table 2 presents research that highlight the importance of blockchain technology at the training level (training of future talents, adapting new training techniques) of technology.

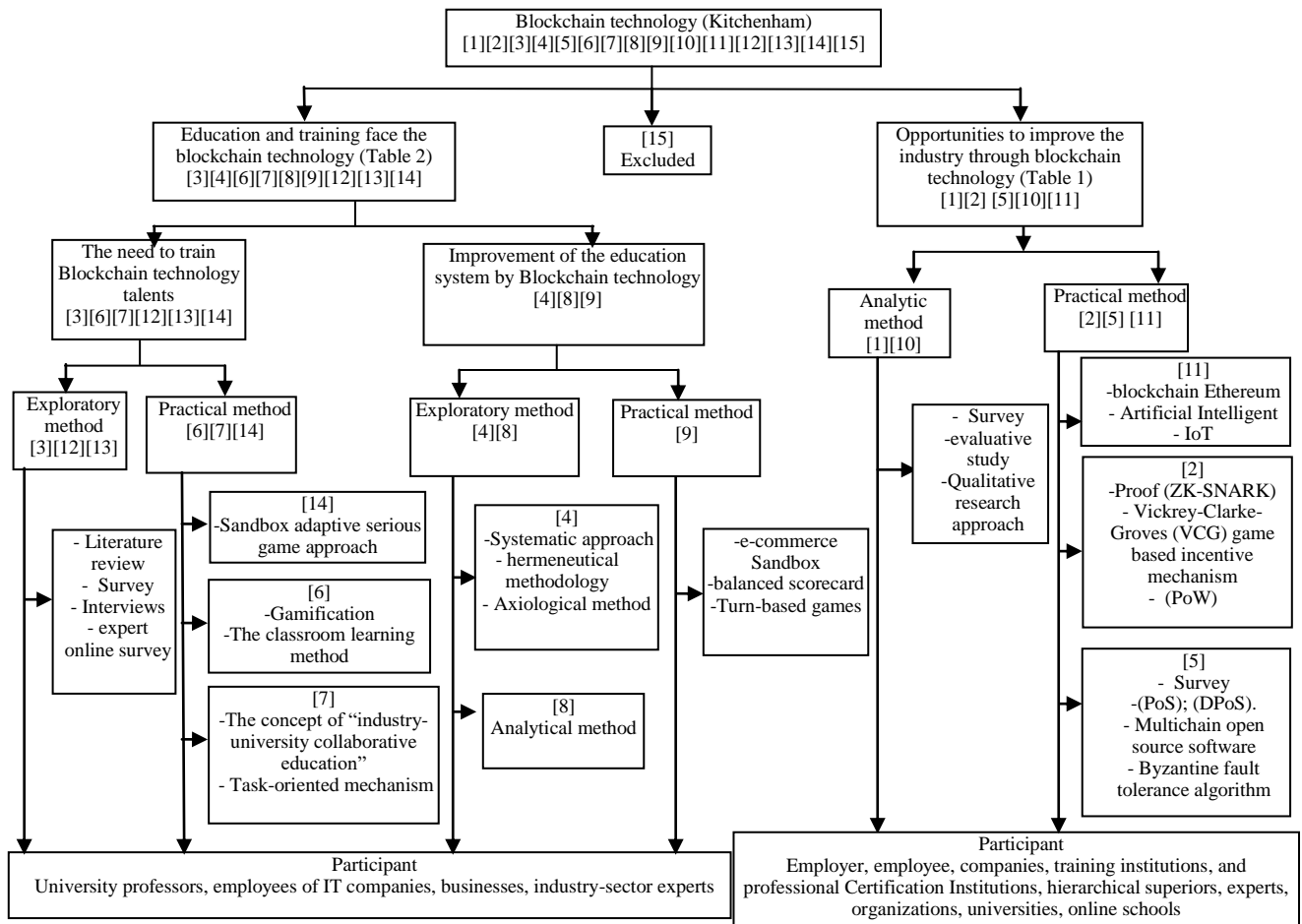


Figure 3. The architecture of the systematic review

TABLE I. BLOCKCHAIN TECHNOLOGY AND HUMAN RESOURCES MANAGEMENT

citation	Aim	technic or method	participant	findings	prospects
[1] N. Pokrovskia et al.	The article serves to digitize the space of the assessment of qualifications and competences for an optimization and increase of the management of human resources.	A survey off line	employer , employee	results show a general hierarchy of the importance of knowledge and skills of highly qualified employees and their line managers.	
[11] O.Fachrunnisaet al.	The aim of this research is to develop a BC-based HR framework to meet the needs of the business and the skills of the workforce. This framework will help the Corporate Training Center to standardize the skills.	-Ethereum Blockchain -IoT - AI	companies, training institutions, Professional Certification Institutions.	-the blockchain is able to generate information on the skills required by the industry. This information will be used by the training center of the company to organize the procedure concerning the competence standards of the workforce.	
[10] D.Dariusz et al.	developed a conceptual model which integrates the description of the Competences and the aptitudes, documents and all the other forms of confirmation of the acquisition of competences	-survey -evaluative study	employer , employee , organizations	The proposed model ensures the unification of the way in which documents confirming the qualifications possessed are represented and can thus form the basis for the construction of a system intended to verify their credibility.	Introduce the proposed system first in Poland. However, they will only use universal solutions that can be easily accepted by other EU members as well as third countries.
[2] L.Liu et al.	the item is used for Employee background check (candidate qualifications, such as employment, education and skills) for recruitment with blockchain	- (VCG) game based incentive mechanism - (PoW) - C++, Data Analytics			
[5] H.Onik et al.	Proposed a blockchain-based recruitment management system (BcRMS) as well as a blockchain-based human resources management system (BcHRMS) algorithm.	- survey -(PoS)(DPoS). - Multichain open source - Byzantine fault tolerance algorithm	employer , employee , organizations	The proposed system offers empowered users, higher quality and reliable recruitment and management, inter-process integrity, faster transaction and decision with lower cost	

TABLE II. BLOCKCHAIN TECHNOLOGY AND TRAINING

citati on	Aim	technics or methods	particip ant	fadings	prospects
[3] N.Miloslavs kaya et al.	the state of current training for BCT technologies around the world, paying particular attention to security issues.	global survey on BCT training	- Univer-sities - busines ses	42% of the top 50 universities offer at least one BC or cryptocurrency course, and 22% offer more than one.	- preparation of a course with the proposed structure - the development of all the necessary educational and methodical material - website teacher-student interaction
[4] G.N. Takigawa et al.	The article analyzes the innovative possibilities of using new social media technologies blockchain, big date, collective intelligence technologies, artificial intelligence in higher education in Russia	-systematic approach -hermeneutic methodology- axiological method.	universities	- The use of crowdsourcing, blockchain, big data, collective intelligence, AI, meets the needs of higher professional education - creation of reliable guarantees for the protection of the intellectual property of students and teachers,	
[6] K.C. Benson et al.	- the article serves to combine the conceptual theories of active learning and gamification to use them as a pedagogy for the Blockchain - encourages instructors to use their creative talents to produce gamification for Blockchain pedagogy	- triangular game - symmetric key in cryptography - safe gamification, -role-playing game -(asynchronous learning method)	- Instruct or - students	- the application of the theories of interactive learning and gamification, coupled with the asynchronous learning system, can be applied to bring similar advantages in the pedagogy of other disciplines	- a quantitative study aimed at determining the amount of knowledge acquired active learning process would be enlightening in future teaching.
[7] C.Chen et al.	-This paper investigates on the technical requirements of a local company in the city of Weifang and proposes a strategy to train blockchain talents in application-oriented universities.	-the concept of "industry-university collaborative education" - a task-oriented mechanism -Hyperleger Fabric	- training enterprise engineers - students - tutors.	- students learning motivation and reorganize educational elements - the implementation of the strategy successfully in training courses	
[8] Peter Williams	This article considers that universities need to outsource part of their course delivery and assessment in order to remain competitive. It examines a potentially sustainable mission strategy: to move away from narrow academic disciplines to an authentic learning program focused on developing students as full people with rounded education.			-Pilot projects and sharing of expertise between institutions would also be useful at this early stage - universities must be proactive in meeting this last challenge and adapt their missions, structures and practices to maintain viability and sustainability for an uncertain future	
[9] B.Wu et al.	this article proposes a competition mode of application of blockchain technology based on the E-commerce Sandbox of digital education operation	- the balanced scorecard - Fuzzy AHP - Trusted Cloud - Softmax -alliance chain. - e-commerce sandbox	teachers and students	The correlation coefficient obtained is greater than 0.8, which validates the accuracy of the evaluation model. On the system side, by simulating teacher and student scenarios, user operations and data communication with the blockchain system are tested, which validates the technical feasibility of the prototype system.	The author plans to use machine learning to train the evaluation model and continuously optimize the model in the process of increasing the amount of data.
[12] M.M. Milovanova . et al.	The purpose of the article is to analyze the possibilities of business education in teaching and using blockchain technology for business development (blockchain business training)	- analysis of monographs, articles, and specialized literature - an expert online survey		- the state commitment to the formation of a digital society. - the growing demand for qualified specialists in the application of blockchain technologies requires the development of a commercial training course in this field of activity.	
[13] F.Praeger. et al.	the study seeks to apply the fundamentals, identify likely trends and provide BCT education and training programs	-Interviews - literature review -open-ended, semi-structured approach	industry-sector experts	the majority of industrial sectors see the potential of blockchain, either by increasing operational efficiency, reducing transaction costs and creating new growth opportunities.	- the impacts of blockchain on business practices - explore the effectiveness of blockchain training and education
[14] A.Mittal . et al.	The authors offer one of the first such educational tools for blockchain training using an adversarial adaptive sandbox serious game approach for students and tech professionals.	-AI - game experience quiz - adaptive NPC algorithm heuristic techniques -firebase, - chatbox - edutainment -sandbox adaptive serious game	students technology professionals -general public	the introduction of the first serious online game, can increase blockchain technology educational skills for students and industry professionals.	The authors plan to use a subjective questionnaire to determine the effectiveness of their games in terms of user experience

A. *The need to train Blockchain technology talents*

Over time, the challenges of training around the blockchain technology (BCT) multiply, and the question asked is: How to get real "relevant skills" of blockchain projects if there is no comprehensive and practical training on the subject? To solve the issue and identify the challenges and training needs for the mastery of technology, authors of [3] analyze an inventory of current training in the BCT around the world, through a global survey, where they paid particular attention to security issues. They offered training divided into two groups where the first is designed for distance education only and the second for full-time face-to-face training (not online), with a list of standards and books that can support this training and specify the skills sought after mastering a full-time BCT course with exemplary course structure. [12] has analyzed the possibilities of business education in teaching the use of blockchain technology for business development. Based on an expert survey, the main provisions of the business training course "Blockchain: Basic Principles and Application Examples" have been developed, the skills and learning outcomes for this course have been determined, and the sample business program "Blockchain: Fundamentals and Application Examples" were presented.

In order to contribute to the economic development of South Bay, authors of [13] relied on a case study informed by interviews with experts in the fields of BCT and the workforce of the industrial sector, as well as through a literature review and analysis of labor force trends for the region, to inform public officials and policy makers working on issues of new technologies, regional economic development, and investment in the workforce. According to this study, answers suggest that those in the majority of industrial sectors see the potential of blockchain as a disruptive and positive force in their workplace. Many answers highlight the potential of blockchain investments to expand their workplaces, whether by increasing operational efficiency, reducing transaction costs, or creating new growth opportunities.

Other researchers find that BCT involves a lot of theoretical knowledge, which can easily discourage students' enthusiasm for learning. To bridge the gap between theoretical and practical knowledge, the authors have tried to make learning easier. This is the case with [7] where the authors analyzed the technical requirements of a local company in the city of Weifang, they came up with a task-oriented strategy, to train blockchain talents in application-oriented universities. They adopt the concept of "collaborative industry-university education", a strategy that takes into account the real knowledge levels of students in applied universities and sets a reasonable degree of learning difficulty. The strategy has been applied to the School of Computer Engineering of Weifang University and some positive effects have been achieved.

For their part, the authors of [6] and [14] have integrated experiential learning theories using game concepts to engage, motivate and attract student interest to acquire more knowledge. In [14], the authors suggest one of the first

educational tools for blockchain training using an adversarial adaptive sandbox serious game approach for students and tech professionals, which can improve cybersecurity in management systems information where blockchain technology impregnates the corresponding disciplines. They further suggested the use of artificial intelligence (AI) to improve the interactivity of NPCs (Non-Player Character) based on player responses. This research is essential for the introduction of the first serious online game, which can increase educational skills in blockchain technology for students and industry professionals. The authors plan to rate this serious game on a subjective scale based on the Game Experience Survey. In the same context, the authors in [6] chose to use the mid-sized college classroom in the United States to apply the principles of active learning (a process to involve students in the co-creation of the learning experience by sharing leadership and course design, students will be responsible for their own learning), and gamification leading to blockchain education. The used classroom learning method was the asynchronous learning method, in which concepts were categorically divided into blocks. These elementary principles were built on top of each other, which led to the synergistic knowledge and definition of blockchain for the student. The instructor performed these exercises in Introductory Information Technology (IT) courses, as well as higher level ethics and professionalism courses, with the aim of discerning different levels of knowledge regarding the subject of the blockchain. The content of the article encourages instructors to use their creative talents to produce gamification for blockchain pedagogy.

B. *Improvement of the education system by Blockchain technology*

In a world full of transformation that faces the acceleration of innovation and new technologies, the formal educational systems can quickly become obsolete. Educational systems are increasingly called upon to correspond to the realities and needs of societies. To improve the higher educational system in Russia, [4] explores the new needs of their system in the context of the global digitization of society and it analyzes the innovative possibilities of merging new social media technologies, blockchain, big data, artificial intelligence, with each other. At the end, all available knowledge and its supports will be brought together in a single system called collective intelligence and most importantly the guarantee of intellectual property of the latest curricula and educational resources. Authors consider Russian projects for their use in practical activities of teachers, on the basis of systems analysis methods, new directions in training of specialists have been identified and characterized: the development of forms of collective creativity the participation in complex projects based on blockchain technologies, the involvement of young initiative in the framework of crowdsourcing technologies, the development of individualized training based on artificial intelligence technologies. As the acquisition of qualifications became more decoupled from the academy, universities would lose the virtual monopoly they currently enjoy on degrees and would have to reinvent themselves as graduate

educators in a broader sense, to that the university always remains competitive. The article [8] describes the changing nature of graduate occupations and examines the possible impacts of developments in knowledge-intensive work and AI. It examines the analysis of learning and blockchain technologies to assess their potential to automate the secure recognition of student activities and achievements. It makes an original and timely contribution to higher education literature by considering how a convergence of three technologies (learning analytics, (AI) and blockchain) could lead to radical changes.

To go further than the current mode of application of the blockchain which is limited to recording the educational experience of students, the author of [9] offers a competition mode of application of blockchain technology based on the e-commerce sandbox of digital education operation, to help teachers to test students' knowledge and their ability to use the knowledge. This mode applies blockchain technology to effectively simplify the competition process and improve competition efficiency. At the same time, the credibility of the competition is resolved by the characteristics of system transparency and non-disruption of data. To provide traceability information for digital education products, the authors propose to combine with Trusted Cloud.

III. DIGITIZING THE HUMAN RESOURCES AREA IN INDUSTRY THANKS TO BLOCKCHAIN TECHNOLOGY

Authenticating credentials can be a real headache for corporate recruiters. Fraud with false diplomas and approximations during interviews still represent an important part of applications today. In an increasingly competitive job market, the blockchain is one of the strengths of technology that comes from its total transparency particularly in the verification of candidate profiles, verification of diplomas, experiences, their duration, etc. Table 1 presents the research that focused on finding solutions to these problems.

In the same context, [5] proposed a blockchain-based on the recruitment management system (BcRMS) as well as a blockchain-based human resources management system (BcHRMS) algorithm. It is a fast efficient and transparent system using blockchain to reduce the risk to the human resources authority. The proposed system thus provides authentic and effective decision support information for the management of the human resources of an organization. This research reveals that the proposed models can be more efficient than the existing HRM systems in terms of safety, cost, time and quality of work. Thus, the proposed system will have significant effects on the construction of smart cities as well as smart industries in the era of existing industry 4.0 and future industry 5.0.

For the researches [1][10], the authors relied on analytical methods. In [1], it uses blockchain technology to build a global register of certificates of qualification and evaluation of skills, to face the central issue of research in the field of training and professional integration of highly qualified specialties. The register content includes two main characteristics which are requested by the employer and offered by an individual as a potential employee:

- Qualifying characteristics are reflected, as a rule, in educational documents and in professional standards of an industry;

- Competency parameters are presented in the functional description of the vacant positions of the company and in the resumes and portfolios of candidates listing the functional tasks that have been performed in their previous jobs, qualifying characteristics of a person are reflected in a variety of certificates.

For their part, the authors of [10] carry out an in-depth analysis of laws, professional regulations and government reports, a conceptual model has been developed which integrates the description of competences and aptitudes, documents and all other forms of confirmation of skills acquisition. The application of blockchain technology allows all data to be integrated into an autonomous system while using existing skills registers. The computer conceptual model developed by a qualitative research approach meets the requirements of all interested parties: employees, employers and organizations issuing such documents. Based on the model developed for document representation, as an integrator of personal skills, the authors propose an Integrated Personal Competence Ledger (IPeCoL) to collect and provide access to information certifying the possession of specific skills. The proposed model ensures the unification of the way in which documents confirming the qualifications possessed are represented and can thus form the basis for the construction of a system intended to verify their credibility.

To help the Corporate Training Center to standardize the skills then to use them by the human resources department to develop the training material, [11] developed a blockchain-based Human Resources (HR) framework to meet the needs of the business and the skills of the workforce. In order to obtain information on the skills required by the industry, the authors use technological applications: in particular AI and blockchain. By integrating the above two technologies, the blockchain - IoT application is formulated to meet practical skills gap mitigation needs. For proof of concept and validation, the authors are developing a prototype system using the Ethereum blockchain to meet the needs of industry and education as a competent source of skilled labor. The proposed system not only enables holistic HR training content, but also dynamic workforce skills according to business needs. The result of the validation with the prototyping blockchain shows that the blockchain is able to generate information on the skills required by the industry. This information will be used by the Corporate Training Center to organize the procedure relating to the competence standard of the personnel. Accordingly, this information will be used by the training provider to organize the program.

IV. CONCLUSION

Blockchain has been considered as an innovative technology with a strong potential for transformation [19], it is not easy to say whether or not it will revolutionize industrial or educational processes, because most of the challenges facing companies in this area of process management are less technological than organizational and

human. Like any new technology, blockchain is an idea that initially disrupts; it is a double-edged sword on one side, a tool for individual liberation or emancipation; a means of promoting collaboration between different actors, through distributed coordination and consensus mechanisms. On the other hand, a technology that can be used primarily by criminals, eager to evade the rule of law by relying on infrastructures that operate beyond the control of any sovereign authority. And since this technology is still in the research and development stage, most of the studies presented in this article are exploratory in nature and seek to apply basic principles, identify likely trends, and provide education and training programs adequate training for mastery. Education and training in blockchain technology therefore have a key role to play in understanding its mass adoption.

Education is undoubtedly one of the first factors that will ensure that the technological transformation of the 21st century is not missed, given the various future trends in this technology represented in the following, [22]:

- The trend of coding research and development will focus more on the ability to process big data fast.
- Hardware blockchain technology will spread the big data market by improving data speed and security.
- Technologies related to future applications will be developed in close collaboration with encryption techniques, which are an essential part of artificial intelligence and the Internet of Things.
- Exchange-related technologies will focus on solving problems in cryptocurrency transactions.
- Other sections of digital transaction technologies will focus on big data processing.

Each technology has limits in its use, concerning the blockchain there are limits in terms of privacy, the environment, inclusion, its threat to democracy and citizenship, [17].

Finally, the most important factor in the promotion of blockchain technology and their legalization is the commitment of the state in the formation of digital societies.

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