ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

Volume 28 (6), 2019

Yevheniia Polishchuk[1]
Alla Ivashchenko[2]
Oleksandr Dyba[3]

SMART-CONTRACTS VIA BLOCKCHAIN AS THE INNOVATION TOOL FOR SMES DEVELOPMENT

The main aim of the research is to develop recommendations for Cooperative model implementation in order to improve SMEs` performance by cost reduction through automating manual processes and attenuating legal risks regarding code-based SMART-contracts implementation via decentralized blockchain technology. The authors explored the main benefits for business entities of using SMART contracts as a digital tool for automating a large number of business processes in the DLT-system. Among with this, the potential risks for conducting the business activity of SMEs were considered, which could be exemplified as lack of legislation, high volatility of cryptocurrency, attenuation of monitoring level, etc. The usage of blockchain Smart contracts as the part of machine learning could lead to become SME Smarter, more dynamic, more flexible and more integrated with big data, which presupposes innovative component of business development.

In the context of Smart specialization implementation in developing countries in EU, the Cooperative Model between different stakeholders based on SMART contracts in the frame of Smart specialization was designed and proposed by the authors. This Model allows to involve non-top developed regions into the innovative process. Besides SMEs' participation, the Model provides cooperation between other participants: research and innovative centers, universities, government structures, non-government organization, big corporations. It was studied how SMART contracts make review the business process and revolutionize it, improving difficult collaborations between business and science organizations. The fragment of possible Smart contract program code was regarded as an example.

JEL: G12; G15; G24; G32

[1] *Yevheniia Polishchuk is Dr. (in Economics), Professor, Corporate Finance and Controlling Department, Kyiv National Economic University named after Vadym Hetman, e-mail: yivga_83@ukr.net.*

[2] *Alla Ivashchenko is PhD (in Economics), Associate Professor, Corporate Finance and Controlling Department, Kyiv National Economic University named after Vadym Hetman, e-mail: alla.ivashchenko@kneu.edu.ua.*

[3] *Oleksandr Dyba is Dr. (in Economics), Associate Professor, Corporate Finance and Controlling Department, Kyiv National Economic University named after Vadym Hetman.*

Introduction

Innovative SMEs play a pivotal role in the economic growth of every country. Undeveloped SMEs are typical for emerging economies, Ukraine in particular, therefore, finding the relevant ways for further business development is a core problem among existing research mainly focusing on business activity and SMEs. There is a wide range of issues faced SMEs on daily performance, exemplified as:

- firstly, lack of institutional support and underdeveloped infrastructure for running an innovative business;
- secondly, a corrupted component in contract performance, e.g. cooperation between private companies and state institutions in obtaining licenses, getting resources, auditing procedures, etc.;
- thirdly, information asymmetry about best practices of business conducting for further successful functioning;
- following, limited ways of capital attraction over the globe due to lack of export potential distribution and scarce access to finance, especially to International funds;
- next, a high level of financial intermediaries` fees for their services;
- finally, communication problem between SMEs and research centres and innovative universities (high level of mistrusting because universities beware of collaboration with SMEs, while SMEs doubt in universities` innovative capacity.

Blockchain-based Smart contracts could be automatic tool for improving the effectiveness level of business performance for tackling the complex of the mentioned problems. Along with this, Smart contracts could become the basis for Smart specialization implementation in order to improve communication between different groups of stakeholders and accelerate innovative processes in regions.

Literature Review

A considerable amount of literature has been published recently on the blockchain innovation topic. Over the past decade, a great number of research in blockchain-based technologies has emphasized the use of Smart contracts. For instance, Hughes A., Park A., Kietzmann J. and Brown C. (2018) [1] persuade that they can be used not only for cryptocurrency apps but for other business ones. In their articles, they looked through the history of blockchain and discussed how Smart contract could be operated by entrepreneurs, policy-makers, representatives from energy and healthcare sector as well. The other paper below proves it. According to the comprehensive study of Radanovic I. and Likic R. (2018) [2] where they reviewed that blockchain technologies can be widely used in medicine. Smart contracts are applicable to medical insurance. At the same time, they propose how to overcome barriers for Smart contract using in this sphere.

Jamison M.A. and Tariq P. (2018) [3] in their study reveal the myths about Smart contracts utilization. Among them, the authors call removing for trust, high demand in electricity and as well put in doubt the Smartness of Smart-contracts.

There is a lot of papers devoted to Smart contracts in the frame of corruption reduction. For example, Madan C., Sinha A., Sharma K. (2019) [4] in their article regarded them as a way for improving the political situation on the country by decreasing influence of powerful persons.

Hazard J., Sclavounis O., Stieber H. (2016) [5] pinpoint a number of similarities between historical evolutions (for instance, the evolution of printed technology and increasing literacy in European cities, the spread of Protestantism) and blockchain-based Smart contracts development. In the same way, these events are able to change and to decrease the contract costs. Moreover, they are expected to make an impact on the financial exchange.

Smart contracts have a high potential for elimination problems in trade finance. Bogucharskov A., Pokamestov I., Adamova K., Tropina Z. (2018) [6] represent the mechanism of digital letters of credit and factoring based on Smart-contracts and its influence on trade finance process. Then they reveal a set of problems which can be solved with blockchain-based Smart-contracts.

For financial risk monitoring by regulators, Kavassalis P. et al. (2018) [7] offer to use "digital doppelganger" for financial documents making Smart-contract. They conclude that Smart-contracts application can adjust the abilities of regulators to control financial risks of business organizations.

According to the study of Brammeretz W. and Mendelowitz A. (2018) [8], Smart financial contracts should be standardized due to the different possible risks (for example, market risk, counterparty risk, credit and behavioural risks). They also propose the algorithm of its realization. On authors opinion, it allows to reduce cost expenditures for financial companies, financial reporting, regulation, and to increase the transparency of the financial market.

Smart contracts also caused changes related to the audit and financial reporting. Rozario A. and Vasarhelyi M. (2018) [9] suggest about audit quality improvement, at the same time, they debate about challenges related to changes in the world of financial reporting. Therefore, Smart contracts are changing the traditional meaning of accountancy. According to this, Kokina J., Mancha R. and Pachamanova D. (2017) [10] consider in their research paper about how Smart contracts can be adopted at this sphere. They trace the development of this innovative technology in real cases at large transnational auditing firms. In addition, the scientists try to predict the potential areas of Smart contracts applicability in future.

One more evidence about the broad use of blockchain-based Smart contracts is work of Shatkovskaya T. et al. (2018) [11], where they prove that this technology has an influence on the technological paradigm of intellectual property rights. They regard Smart contract as a way of intellectual property rights guarantee. Moreover, they propose to accept at nations level Smart-contract application.

Nowadays, Smart contracts play a crucial role in international trade, improving the supply chain. In this context, Kim H., Laskowski M. (2018) [12] analyzed the ontology and its application at Smart contracts. The last serves as executor of provenance trace and enforcement of traceability at Ethereum blockchain system.

Sun J., Yan J., Zhang K. (2016) [13] point out that blockchain-based Smart contracts can contribute to the Smart city development. Due to this, they designed a conceptual framework with such elements as human, technology and organization. The authors also proved a wide application of Smart contracts at sharing economy projects.

Suliman A., Husain Z., Abououf M., Albooshi M. and Salah K. (2019) [14] worked out the blockchain solution of Smart contracts application in Etherium for data monetization IoT without any intermediary. They focus their study on such key points as business relations, architectural design, logic flows etc.

Smart contracts formed the central focus of a studies by scientists of law. Millard C. (2018) [15] discusses data protection issues and as well pays attention to the identification of conflict types of which occur with disruptive innovations as Smart contracts. There is also a study of Giansparo M. (2017) [16] who discuss Smartness of Smart-contracts idea. In spite of Smart contracts' benefits, he emphasis on negative factors of Smart contracts for traditional intermediaries. In addition, the author makes a forecast about the difficulties of Smart contract law adaptation. Shermin V. (2017) [17] suggests that blockchain-based Smart contracts are a disruptive innovation which can lead to the serious structural changes in management in future, but at the same time there is a problem of all sides stockholders' consensus. It is quite difficult to reach it; therefore, new agents' problems may strike, and it can provoke a different type of risks. The similar opinion has had Krabec T. and Venegas P. (2017) [18]. Thus, the researchers claim that Smart contract is in balance among their utility and decentralization risk.

Marend N., Norta A., Mahunnah M., Ma L. and Maggi F. (2016) [19] regard conflicts at virtual enterprises which use Smart contracts and the ways of their solutions. They propose the algorithm which can eliminate the problem or at early stage to solve it. This algorithm was used in automotive production entity. In addition, some of these scientists (Dai, P., Mahi, N., Earls, J., & Norta, A. (2017)) [20] considered the advantages of Qtum technology and its utility and blockchain and try to predict the development of Smart contracts apps for industry case.

Far and away, these and other research on blockchain-based Smart contracts help to understand what is already studied about. Nevertheless, there are related problems with the application of this innovation in the frame of Smart-specialization Strategy in the European Union, which is a core interest of our research.

1. Theoretical Background of Smart Contracts via Blockchain

Smart contracts are contracts which execution depends on pre-determined conditions exemplified as payment terms, collateral, privacy, enforcement, etc. and proceeds in a secure environment, namely Blockchain without third parties`meddling.

In term, Blockchain represents the digital network and distributed ledger technology (DLT), which allows to verify, execute and record all transactions, performing via this technology. It is a certain computer algorithm using cryptographic encryption for every transaction execution in a distributed network. Blockchain presupposes computer protocol usage aimed at control digital assets and its flow only in case of proper validation by digital signature confirmation.

Though, Smart contracts are computer-coded agreements on every Blockchain among which Etherium (ETH) is mainly applied in business processes. The most popular Blockchain application, namely Bitcoin (BTC), allows to record the mining, creation and transfer of bitcoin, while ETH along with the mentioned options stores such computer scripts as Smart contracts and decentralized applications simultaneously recording their state on every stage of contract performance.

The Smart contract usage in business activity enables to optimize different processes like minimization the need of mediators (banks, lawyers, notaries, other financial institutions), cost and time efficiency for newly developed or existing business models. These contracts are based on a traceable and irretrievable way of execution through Blockchain technology.

Only electronic implementation principle, pre-defined conditional nature, self-sufficiency, self-execution and high level of certainty could be considered as features of Smart contracts performance. Every Smart contract via Blockchain characterizes by absolute transparency for all parties within the defined system, which means that no transaction actor could deselect or pull unilaterally from any action made in Blockchain. This feature allows to eliminate the risk of uncertainty of contract performance, possible fraud and transform traditional transactions through intermediaries to automatically executed electronic ones.

The detailed analysis of Smart contracts with underlining the main principles, types and advantages for implementation into business activity is shown in Fig. 1.

These all mentioned benefits, especially lack of mediator services, cost and time efficiency, savings in operational costs and reduction of different risks, could be considered as useful tool for business performance by SMEs in order to promote their further development, increase their real potential, improve their investment attractiveness and eliminating the level of information asymmetry.

In previous research authors [26] emphasized that establishing of Information and Communication Platform could be the solution for the reduction of financial and information illiteracy among Ukrainian SMEs by the availability of such data as governmental regulation procedures, funding programmes, different investment programmes, analytical reports and expert conclusions, etc.

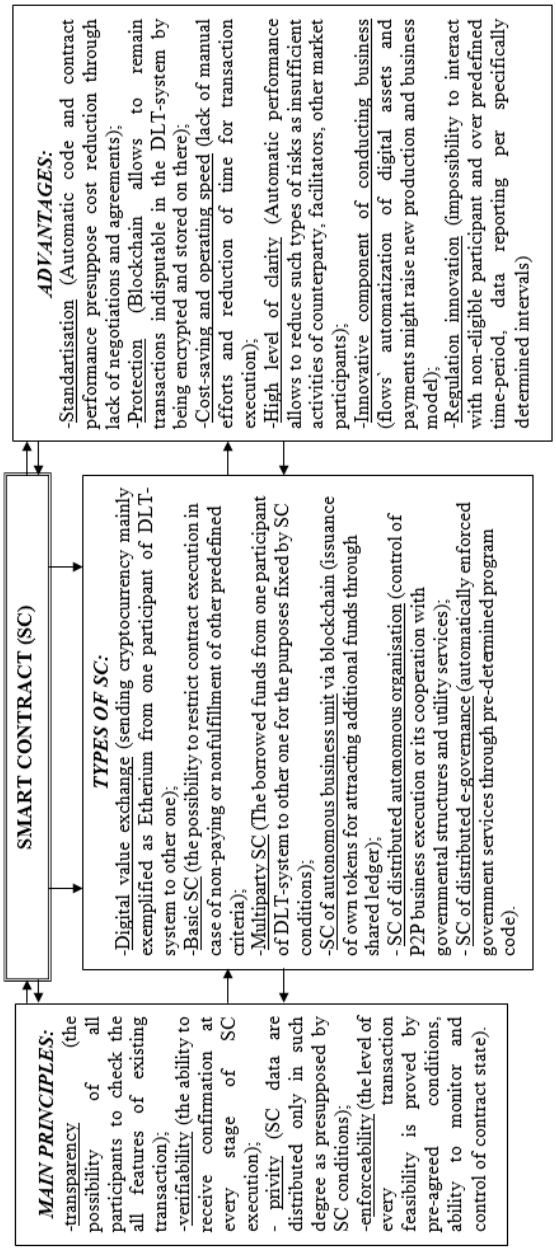
Additionally, to the proposed view, asymmetric information can be minimized by Smart contracts usage by the execution of opportunistic behaviour, lack of mistrusting and fraud by automatization of all transactions [27].

The usage of these digital protocols namely Smart contracts could overcome different risks which are mainly connected with the contractual relationship by raising the level of

traceability, controllability, accountability, feasibility meanwhile reduction expenses which are very beneficial in case of SMEs.

Figure 1

Essentials of Smart contract execution via Blockchain



Source: formed by authors on the basis of [21-23]

2. Benefits vs Potential Risks of SME Smart Contracts

Applying digital Smart contracts into business activity does not require a set of actions to be concluded, which includes the identification through digital key, blockchain technology via which deal will be encrypted, the cryptocurrency wallets for connection to real business activity (necessary amount of digital currency is frozen and stored in blockchain until the contract validation) and predetermined conditions under which the contract will be fulfilled.

The possible benefits for SMEs can be considered as follows:

- time efficiency (no document verification by legal institutions, all transactions can be done automatically, speeding up of information processing and its validation by predefined conditions);
- cost-efficiency (cost optimization without any fees to intermediaries like banks and non-banking institutions for transaction processing);
- the autonomy of deals (no need of real presence of participants for contract validating because of the self-executed protocol in which all contract fundamentals as collecting funds, transaction realization, resources` distributing are encrypted in the application program code);
- full decentralized contract (no control from one central server or legal authority, contracts perform in DLT system);
- high level of security (without reliance on third party actions, all transactions blockchain technology allows to record and store data about all transactions preventing from lost or change of data, and the cases of data-stealing from decentralized system are also impossible).

Along with improving the effectiveness of the business activity, there is a set of disadvantages, which detailed analysis is considered in fig. 2.

Among them, the most influential ones are:

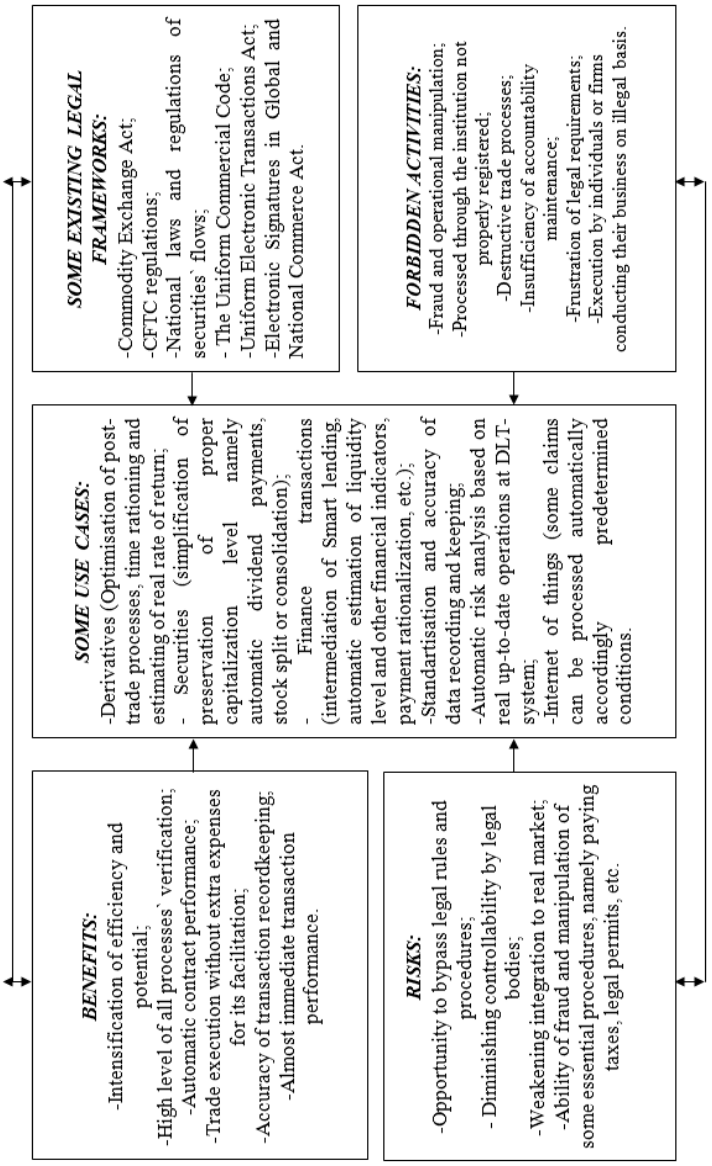
- uncertainty in regulation and legal status (implementation of some regulatory framework could eliminate possible risks connecting with crypto activities);
- behavioural component (the possibility of human error in code encryption can lead to increase of vulnerability risks);
- no changes (in the case when the contract was executed it is impossible to make changes or cancel the deal);
- the possible implementation only by additional help from specialized Blockchain developer.

Such spheres as accounting, banking, insurance, trade finance, stock exchanges, etc. apply blockchain technologies into their activities [28]. Though, Financial and IT sectors are pioneers in implementing Blockchain.

It was estimated that Smart contracts in DLT system could lead to cost reduction up to 18,4 bln Euro annually by 2022 [29]. According to European Union assessment about 4,6 bln Euro was invested into the international payments system operating on blockchain [30].

Figure 2

Features of Smart Contract Applicability into SME activities



Source: formed by authors based on [22-25]

One of the successful cases of Smart contract implementation is SMART Grid, that means modernized power supply networks that use information and communication and technologies to collect data on energy production and energy consumption, which automatically improves efficiency, reliability, economic benefits, and sustainability of production and distribution of electricity. Now there are several types of energy (water, solar, wind, coal burning, atomic etc.) and these networks are very complicated therefore previously it is difficult to identify from what type of energy and how much the consumer receives it. The consumers earlier as well could sell their excessive energy if they had obtained the certificate of green energy producer. It took a lot of time and involved personal and only after receiving confirming that status document they could sell it signing traditional contracts. With the appearance of Smart contracts, the process of data collection, receiving a certificate and signing the treaties became shorter and easier. Because of the blockchain platform, the sellers and buyers are registered, and they have a choice right what supplier of electricity is the most appropriate and as well what consumer is suitable in the frame of partnership.

Though, in such SME activities, which are connected with P2P transactions, secure data sharing, information transfer and storage of any trade processes, it is beneficial to apply Smart contracts considering the potential risks and benefits.

3. Redefinition of Doing Business within Smart Contracts

The current business model could be innovated via Blockchain, which creates a new form of collaborative cooperation between different agents based on trust and transparency.

Despite all advantages of implementation of Blockchain based business model, there is no mass its application in conducting business.

Smart contracts could easily lead to a redefinition of SMEs, enabling enhance the creativity of private entrepreneurs, trough transformation traditional services to automatic ones because of open-source code for blockchain application.

Smart contracts are also considered as far as the type of artificial intelligence where machine-to-machine automatic processing could make every transaction without human interaction. Along with this, the key role is played by the trust, which is typical for Blockchain technology by default. As a result the most corrupt economies might change their general policy. In this case, SMEs have the potential to raise their capacities and innovativeness by applying all the mentioned benefits and resources.

The blockchain-based business model is characterized by:

- ability to attract capital directly from investors over the globe without using funding schemes as crowdfunding, angel investment or investment by ventures or to raise funds from the public through ICO (restructuring traditional funding schemes as fundraising and traditional investing);
- almost simultaneous liquidity with blockchain tokens;

- the real reward for adopters and complementors with krypto tokens by formation communities at early-stage of development;
- capacity to continue development through token trade within open-source projects.

In the context of SME development, Smart contracts could become an effective way for a time, cost and human sources. Redefinition traditional business model for SME could attract additional capital through tokens performing their activity via Blockchain-based on proposed in next chapter cooperation model.

4. Smart for Smart (Smart contracts for Smart Specialization)

A smart specialisation is a new approach that aims to increase economic growth and job places in European countries, where each region can develop its own competitive features. It also means that a great number of stakeholders join to common innovative projects. Among participants of the Smart specialized project can be SMEs, research and innovative centres, universities, government structures, non-government organization, big corporations. Although all of them united by a common idea, usually, projects with a high number of members feel problems related to a relationship forming, including making contracts.

Therefore, Smart contracts due to their abilities are called to solve them. The Model of cooperation in the frame of Smart specialization between different stakeholders based on SMART contracts can help to realize the project cutting off mentioned problems. In our opinion, Smart contracts are the instruments which will help to create an ecosystem for efficient implementation of Smart specialization strategy. In addition, it'll allow to take part for stakeholders from non-EU countries because it escapes the problem of low transparency, corruption, failure to comply with the undertaken obligations.

Below there is the schematic description of Model of cooperation in the frame of Smart specialization between different stakeholders based on SMART contracts. At the Blockchain platform, it is possible to describe the actions between stakeholders by following code (fragment of code), described in fig. 3.

The developed Cooperative Model (fig. 4) requires the completion of the next steps:

0 step – Forming database by stakeholders (SMEs, Research Centers, Universities, NGOs, corporations) from different regions. One of them has a need to implement innovation development into their activity. The others have resources and the possibility to develop these innovations. The advantage of the database which is allocated at Blockchain Contract is that Research Centers and Universities can easily cooperate in spite of different barriers (distance, asymmetry of information etc.)

1 step – Agreement of Smart contract conditions between stakeholders. It means that on this phase, parties discuss the price of research and development, terms, responsibilities, amount of work, specific of work, force majors etc. This step is rather important because this is the case of a non-flexible contract; therefore, potential partners should pay attention to this aspect.

2 step – Smart contract formalization. Ordering innovation customer transfer funds on an account at Blockchain platform, then convert them into cryptocurrency and froze there until the work will be done and executor will deliver the result of R&D. If the conditions of the Smart contract will be accomplished, then the University / R&D Center / Innovative SME will receive the cryptocurrency. It is also possible to exchange them into real money. If the conditions will not be executed, then funds automatically transfer on the ordering innovation customer.

Figure 3

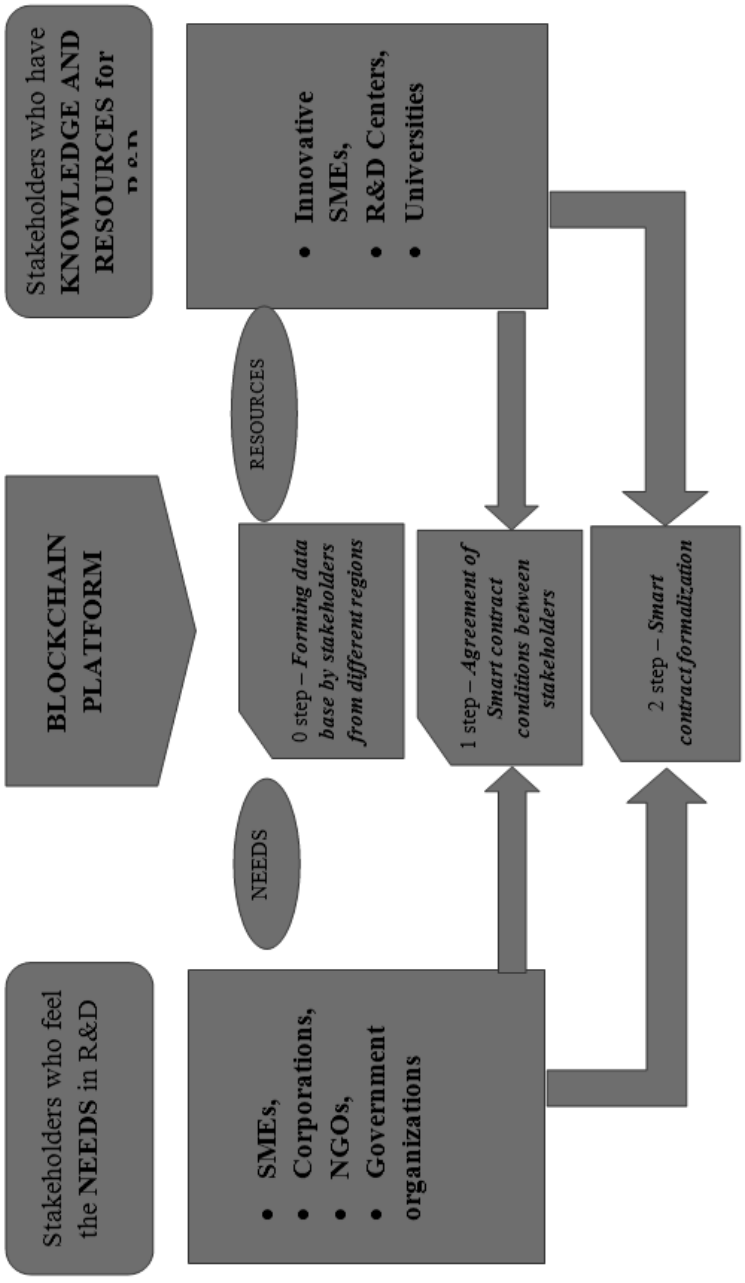
Fragment of code for Smart contract execution by SMEs

```
contract MyToken {
   /* This creates an array with all balances */
   mapping (addressSME => uint256) public balanceOf;
   /* Initializes contract with initial supply tokens to the creator of the contract */
   constructor(
      uint256 initialSupplyResearch
      ) public {
      balanceOf[msg.senderCoreSystem] = initialSupplyResearch;
   }
   /* Send coins */
   function transfer(address _to, uint256 _value) public returns (bool success) { // Send
coins to research group
      require(balanceOf[msg.sender] >= _value);          // Check if the sender has enough
      require(balanceOf[_to] + _value >= balanceOf[_to]); // Check for overflows
      balanceOf[msg.sender] -= _value;                   // Subtract from the sender
      balanceOf[_to] += _value;                          // Add the same to the recipient
                  require(allSMERequirement.isDone());                                    //
Ensure that all SME requirement has been done
      return true;
   }
}
```

This Model (fig. 4) allows to join stakeholders from different regions, finding the most appropriate variant for the R&D research. In addition, it may boost the action plan of the Smart specialization strategy.

Figure 3

Cooperative Model between different stakeholders based on SMART contracts in the frame of Smart specialization



Conclusions

Disruptive technical innovations like Blockchain-based Smart contracts definitely redefine the traditional business model. Designed Cooperative Model between different stakeholders based on SMART contracts in frame of Smart specialization with developing specialized Smart program code allows to increase influence on business such potential benefits as cost- and time-efficiency, manual processes` optimization, improvement of accuracy level, etc. and eliminate the possible risks namely lack of regulation framework, human factor in possible errors of code programming and predetermined conditions, possible fraud of some procedures, like paying taxes, legal permits and so on.

In the context of Ukraine readiness to join to Smart specialization strategy, there is an urgent need to adopt legislative, technical, managerial and financial requirements in order to have the capacity for implementation the developed model. Some specifics of each requirement should be clarified as follows:

- legislation: on National level the forms of Smart contracts should be indorsed alleviating the bureaucracy level at such inflexible structures as traditional universities and research centres;
- technology: access to data of Smart contract transactions does not require special knowledge and skills for ordinary users, while installation of program code for Smart contract formalization needs specified skills of program developer;
- Management: Smart contract execution relies on predefined conditions designed by related personnel (managers, lawyers, financial analysts, etc.); they should be prepared after course completion to meet instruction of Smart contract usage. As Smart contracts provide transparency and reduce corruption, there is a need to conduct elaborative work with the mentioned users;
- finance: using Blockchain technology does not presuppose high financial fees, whereas the development of Smart contract program code needs some financial sources for these services.

The role of higher education institutions in the frame of the Smart specialization strategy is reconsidered. Therefore, for Ukrainian universities and other innovative structures, a new phase of developing is coming soon. They should be ready for them and as well for the new forms of cooperation with the private sector. SMEs have already started to use Smart contracts, and universities have to be ready to apply them as well for better and more efficient partnership. It means that they have to predict the risks' reduction related to Smart contracts and develop a sophisticated system of Smart contract conditions.

Implementation of the proposed Cooperative model by SMEs could lead not only to the improvement of collaboration between private, research and other stakeholders but also to better business performance by automatization of the most significant business processes.

References

1. Bogucharskov, A., Pokamestov, I., Adamova, K., Tropina, Z. (2018). Adoption of blockchain technology in trade finance process. – Journal of Reviews on Global Economics, Vol. 7, Special Issue, pp. 510-515 - https://doi.org/10.6000/1929-7092.2018.07.47, last accessed 2019/02/09.
2. Brammeretz, W., Mendelowitz, A. (2018). From digital currencies to digital finance: the case for a Smart financial contract standard. – Journal of Risk Finance. Vol. 19, p. 76-92 - https://doi.org/10.1108/JRF-02-2017-0025, last accessed 2019/02/12.
3. Dai, P., Mahi, N., Earls, J., Norta, A. (2017). Smart-Contract Value-Transfer Protocols on a Distributed Mobile Application Platform. https://qtum.org/uploads/-files/cf6d69348ca50dd985b60425ccf282f3.pdf, last accessed 2019/01/30.
4. Durovic, M., Janssen, A. The Formation of Smart Contracts and Beyond: Shaking the Fundamentals of Contract Law? file:///Users/Alla/Downloads/formationofsmartcontractslong.pdf, last accessed 2019/02/16.
5. Ethereum: A blockchain-based Smart contract platform, University of Oslo, https://www.uio.no/studier/emner/matnat/ifi/IN5420/v18/timeplan/resources/summary-fifth-topic/ethereum-slides.pdf, last accessed 2019/02/16.
6. Giancaspro, M. (2017). Is a 'Smart contract' really a Smart idea? Insights from a legal perspective. – Computer Law and Security Review, Vol. 33, N 6, pp. 825-835 - https://doi.org/10.1016/j.clsr.2017.05.007, last accessed 2019/02/12.
7. Gurguc, Z., Knottenbelt, W. Cryptocurrencies: Overcoming Barriers to Trust and Adoption, Imperial College London, https://www.imperial.ac.uk/media/imperial-college/research-centres-and-groups/ic3re/cryptocurrencies--overcoming-barriers-to-trust-and-adoption.pdf, last accessed 2019/02/16.
8. Hazard, J., Sclavounis, O., Stieber, H. (2016). Are transaction costs drivers of financial institutions? Contracts made in heaven, hell, and the cloud in between. – New Economic Windows, pp. 213-237 - https://doi.org/10.1007/978-3-319-42448-4_12, last accessed 2019/02/10.
9. Hughes, A., Park, A., Kietzmann, J. and Brown, C. (2019). Beyond Bitcoin: What blockchain and distributed ledger technologies mean for firms. Business Horizons - https://doi.org/10.1016/j.bushor.2019.01.002, last accessed 2019/02/13.
10. Ivashchenko, A. I., Sybirianska, Yu. V., Polischuk, Ye. A. (2017). Information and Communication Platform as a Complex Approach for Solving Information Asymmetry Problems. – The ICTERI 2017 Proceedings Vol. 1844, http://ceur-ws.org/Vol-1844/10000111.pdf, last accessed 2019/02/16.
11. Jamison, M. A., Tariq, P. (2018). Five things regulators should know about blockchain (and three myths to forget). – Electricity Journal, Vol. 31, N 9, pp. 20-23 - https://doi.org/10.1016/j.tej.2018.10.003, last accessed 2019/01/16.
12. Kavassalis, P. et al. (2018). An innovative RegTech approach to financial risk monitoring and supervisory reporting. – Journal of Risk Finance, Vol. 19, N 1, pp. 39-55 - DOI: 10.1108/JRF-07-2017-0111, last accessed 2019/01/18.
13. Kim, H., Laskowski, M. (2018). Toward an ontology-driven blockchain design for supply-chain provenance. – Intelligent Systems in Accounting, Finance and Management, Vol. 25, N 1, pp. 18-27 - https://doi.org/10.1002/isaf.1424, last accessed 2019/02/09.
14. Kokina, J., Mancha, R., Pachamanova, D. (2017). Blockchain: Emergent industry adoption and implications for accounting. – Journal of Emerging Technologies in Accounting, Vol. 14, N 2, pp. 91-100 - https://doi.org/10.2308/jeta-51911, last accessed 2019/02/01.
15. Krabec, T., Venegas, P. (2017). Trust Design: Balancing Smart Contracts Utility and Decentralisation Risk. – International Advances in Economic Research, Vol. 23, N 4, pp. 433-

435 - https://doi.org/10.1007/s11294-017-9660-x, last accessed 2019/01/19, last accessed 2019/02/02.
16. Lab CFTC. (2018). A Primer on Smart Contracts. November 27, https://www.cftc.gov/sites/default/files/2018-11/LabCFTC_PrimerSmartContracts112718.pdf, last accessed 2019/02/16.
17. Madan, C., Sinha, A., Sharma, K. (2019). Success of blockchain and bitcoin. – International Journal of Recent Technology and Engineering, Vol. 7, N 5, p. 7.
18. Marend, N., Norta, A., Mahunnah, M., Ma L., Maggi, F. (2016). Sound conflict management and resolution for virtual-enterprise collaborations. – Service-Oriented Computing and Applications, Vol. 10, N 3, pp. 233-251 - https://doi.org/10.1007/s11761-015-0183-0, last accessed 2019/02/01.
19. Millard, C. (2018). Blockchain and law: Incompatible codes?. – Computer Law and Security Review, Vol. 34, N 4, pp. 843-846 - https://doi.org/10.1016/j.clsr.2018.06.006, last accessed 2019/01/18.
20. Probst, L., Frideres, L., Cambier, B., Martinez-Diaz, C. (2016). PwC Luxembourg. Blockchain applications & services, Business Innovation Observatory, European Union, April 2016.
21. Radanovic, I., Likic, R. (2018). Opportunities for Use of Blockchain Technology in Medicine. – Applied Health Economics and Health Policy, Vol. 16, N 5, 1 pp. 583-590 - https://doi.org/10.1007/s40258-018-0412-8, last accessed 2019/01/25.
22. Rozario, A., Vasarhelyi, M. (2018). Auditing with Smart contracts. – International Journal of Digital Accounting Research, Vol. 18, pp. 1-27 - DOI: 10.4192/1577-8517-v18_1, last accessed 2019/02/04.
23. Sadiku, Matthew N. O., Eze, Kelechi G., Musa, Sarhan M. (2018). Smart Contracts: A Primer. – Journal of Scientific and Engineering Research 5(5), p. 538-541.
24. Shatkovskaya, T. et al. (2018). Impact of technological blockchain paradigm on the movement of intellectual property in the digital space. – European Research Studies Journal, Vol. 21, Special Issue 1, pp. 397-406.
25. Shermin, V. (2017). Disrupting governance with blockchains and Smart contracts. – Strategic Change, Vol. 26, N 5, pp. 499-509 - https://doi.org/10.1002/jsc.2150, last accessed 2019/02/15, last accessed 2019/02/20.
26. Subassandran, R. (2018). Blockchain and Smart Contracts: Today and Tomorrow. Report Date: 2 May 2018, http://www.courtsofthefuture.org/wp-content/uploads/Blockchain-Smart-Contracts-Today-and-Tomorrow.pdf, last accessed 2019/02/16.
27. Suliman, A., Husain, Z., Abououf, M., Albooshi, M., Salah, K. (2019). Monetization of IoT data using Smart contracts. – IET Networks, Vol. 8, N 1, pp. 32-37 - DOI: 10.1049/iet-net.2018.5026, last accessed 2019/01/20.
28. Sun, J., Yan, J., Zhang, K. (2016). Blockchain-based sharing services: What blockchain technology can contribute to Smart cities. – Financial Innovation, Vol. 2, N 1, article number 26 - https://doi.org/10.1186/s40854-016-0040-y, last accessed 2019/01/12.
29. The Blockchain Revolution – The Swiss Perspective. White Paper. February 2017. Deloitte, https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/innovation/ch-en-innovation-blockchain-revolution.pdf, last accessed 2019/02/22.
30. The Fintech 2.0 Paper: rebooting financial services, antanderinnoventures.com/wp-content/uploads/2015/06/The-Fintech-2-0-Paper.pdf, last accessed 2019/02/22.