THE USE OF BLOCKCHAIN AS A DIGITAL TOOL IN THE DEVELOPMENT OF ORGANIC AGRICULTURE IN REPUBLIC OF SERBIA

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Abstract: *The aim of this paper is to present the Blockchain technology as a digital tool that can be used in the development of organic production at the level of the Republic of Serbia. Although blockchain is used in cryptocurrencies, according to data from the EU in previous years it has been successfully applied in the food supply chain. In the Republic of Serbia, the area under organic agriculture amounts to 0.5%, while in the territory of the EU 15, that area is significantly larger and amounts to 18.6%. Non-transparency, high administration and certification costs, and short trust of end customers are the main culprits for the slow expansion of organic agriculture. This can be changed by using Blockchain technology through the creation of electronic databases with the possibility of easy access to all stages of organic production. Control of organic farming will be facilitated and improved, ultimately resulting in a transparent market for organic products in which consumers have full confidence.*

Key wors: *blockchain technology, digitalization, organic production, Republic of Serbia.*

INTRODUCTION

Blockchain technology is originally the name given to advanced database mechanism that allows transparent information sharing within a business network. The database stores data in blocks that are lined together in a chain. The technology is related to the digital currency Bitcoin (Ammous, 2016). It is an emerging digital technology which allowing ubiquitous financial transactions among distributes untrusted parties, without the need of intermediaries such as bank (Kamalaris et al.). The key feature of a blockchain is its ability to keep a consistent view and agreement among the participants (i.e., *consensus*) (Bano, 2017), even if some of them might not be honest (Castro & Liskov, 1999).

One of the most common applications of blockchain technology is recognized in agriculture/food production. In agriculture is being used for improving food safety and transaction times. The increasing interest calls for a clear, systematic overview (Bermeo-Almeida et al., 2018). In any nation’s economy, agriculture plays an essential role in helping to fees the whole population. The agriculture industry is the main source of labor in most countries (Sajja et al., 2023). Major applications of blockchain are listed as follows: agricultural insurance, smart farming, traceability, land registration, food supply chain, security and safety of farms, e commerce of agricultural products, etc. (Demestichas et al., 2020).

Food is one of the most basic human needs that supplies human body with nutrients that in various metabolic process makes construction of new cells and regeneration. From that point of view agricultural supply chain management is made one of the most complicated and demanding process. The blockchain technology can be used for monitoring the origin of the food and so assist construct reliable chains of food supply and increase customer confidence, especially in organic food production (Kovacevic et al., 2023;). Also, organic food supply chain companies aiming to improve food traceability with blockchain face two key decisions, depending on the characteristics of the organic value chain, regarding (1) optimizing chain partner collaboration and (2) the selection of which data to capture in the blockchain (Van Hilten et al., 2020).

1. MATERIAL AND METHODS

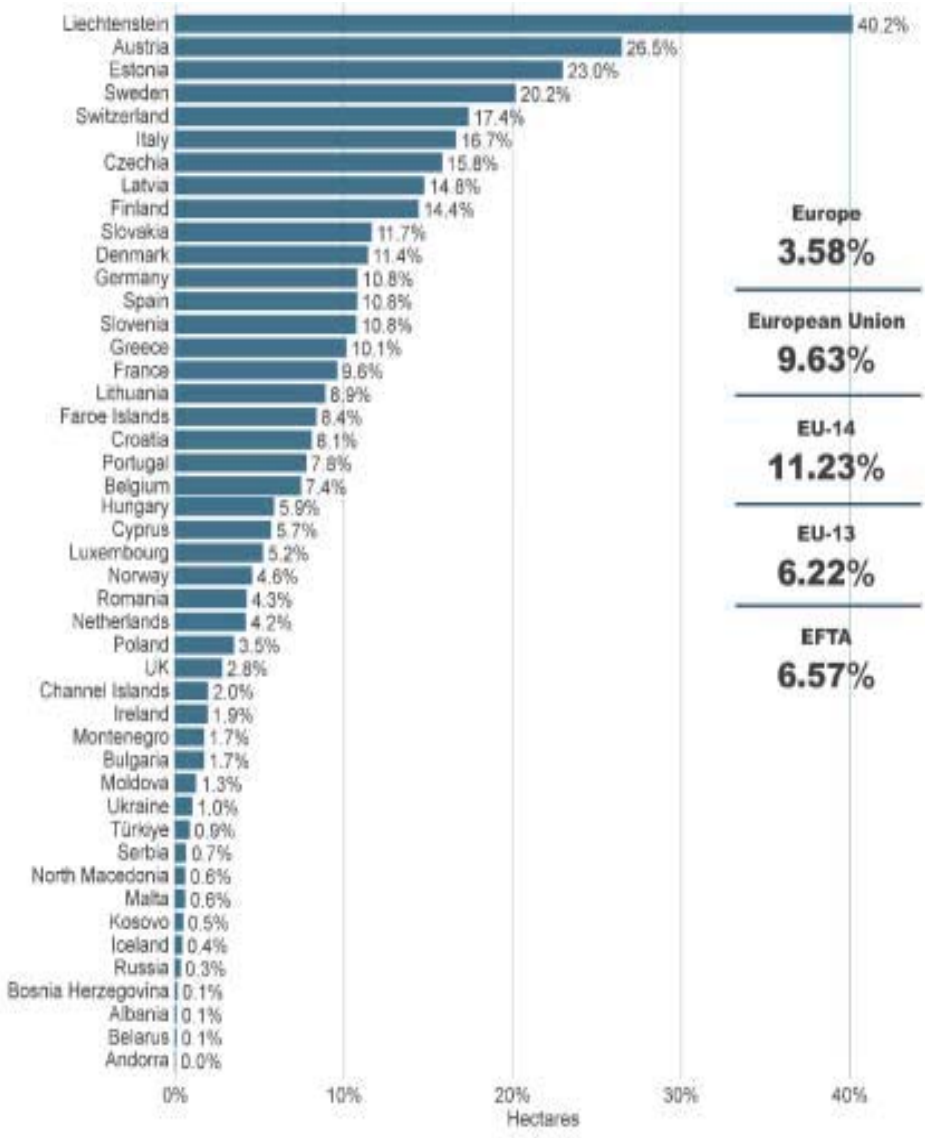
In this paper collected material from scientific research about these relatively new topics, which can be used for improving organic food production in Republic Serbia. The applied methodology relies on intensive literature research with consultation with organic farmers, chain representatives, food processors, certified bodies and institutions, also relies on consultation with experts from field of marketing foodstuff.

2. ORGANIC PRODUCTION

The organic production is a sustainable food production system which is designed to implement all agroecological principles that enable the preservation of human and animal health, environmental protection, and positive impact of society and the ecosystem while achieving significant economic impact benefits (Tegeltija et al., 2022). Organic agriculture has been defined as production focused on reduced input use and the preservation of ecosystems functions (Kovačević, 2021).

In 2021, over 76,4 million hectares of organic agricultural land, including in-conversional areas, were recorded. The regions with largest organic agricultural land areas are Oceania and Europe (17,8 million hectares, 23 %). In territory of EU is recorded 15,6 million ha, and top 3 countries in Europe by organic production are France (2,8 million hectares; Spain with 2,6 million hectares and Italy with 2,2 million hectares). European organic farmland increased by almost 0.8 million hectares. Almost half of the organic farmland is used for arable crops, strong growth of oilseeds (Willer et al., 2023).

Figure 1. Organic shares of total agricultural land in 2021 (in %)



Source: Willer et al., 2023

In 2022, the share of agriculture in Serbia's gross domestic product was 6,5% (https://data.stat.gov.rs). Organic share of total agricultural land in 2021 in Republic Serbia amounts 0,7%, which is increasing of almost 40% in regards

to 2018, when it was recorded 0,5% of agricultural land under organic production (Figure 1).

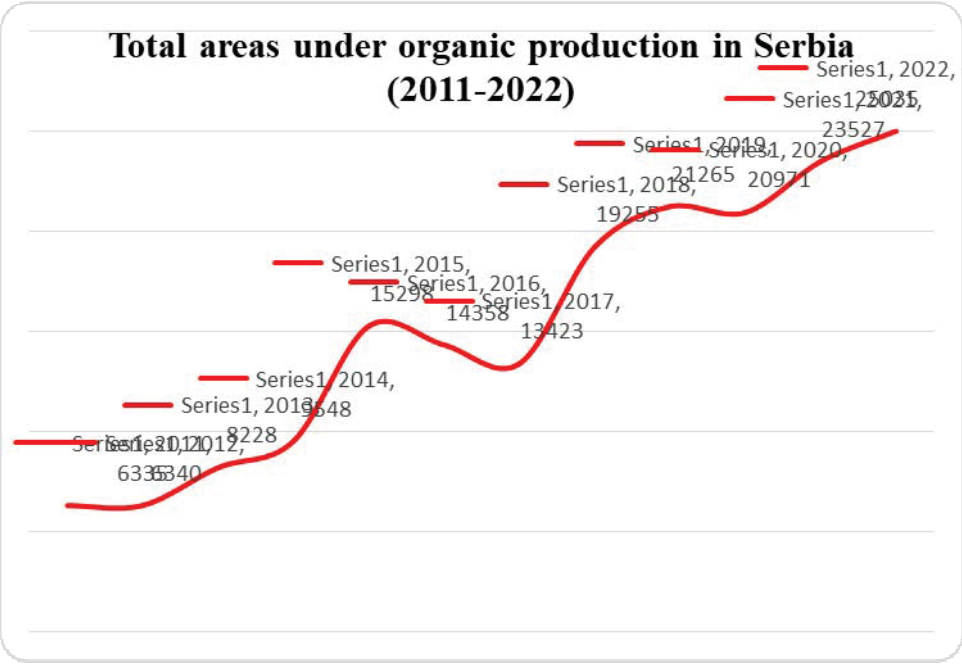
Republic Serbia is one of the ten countries with the highest growth in organic agricultural land in percentage in 2021, besides North Macedonia, Bosnia and Herzegovina, Iceland, Cyprus, Romania, Ireland, Luxembourg and Croatia (Figure 2).

Figure 2. The ten countries with the highest growth in organic agricultural land in percentage in 2021

Source: Willer et al., 2023

Organic plant production in Republic Serbia in 2022 takes 25.035 ha, which is for 6,41% highest than total areas under organic production in 2021. For the period 2011-2022., it is noted an almost constant increase in areas, with a small deviation in the period 2015-2017, when the areas under organic production decreased (Graph 1).

Graph 1. Total areas under organic production in Serbia (2011-2022)



Source: MAFWRS, 2023

Application of blockchain technology increasing in agriculture in recent years. According to Tripoli et al., 2018, the overlap between agriculture and blockchain architecture is in the following aspects:

- Suppliers put information of the pesticides, fertilizers and used machinery.
- Producers generate information on the farm, farming practices, plant diseases, weather condition animal welfare.
- Information on processing plants.
- Information on transport and storage conditions.
- Retailer information, including information on each foodstuff.

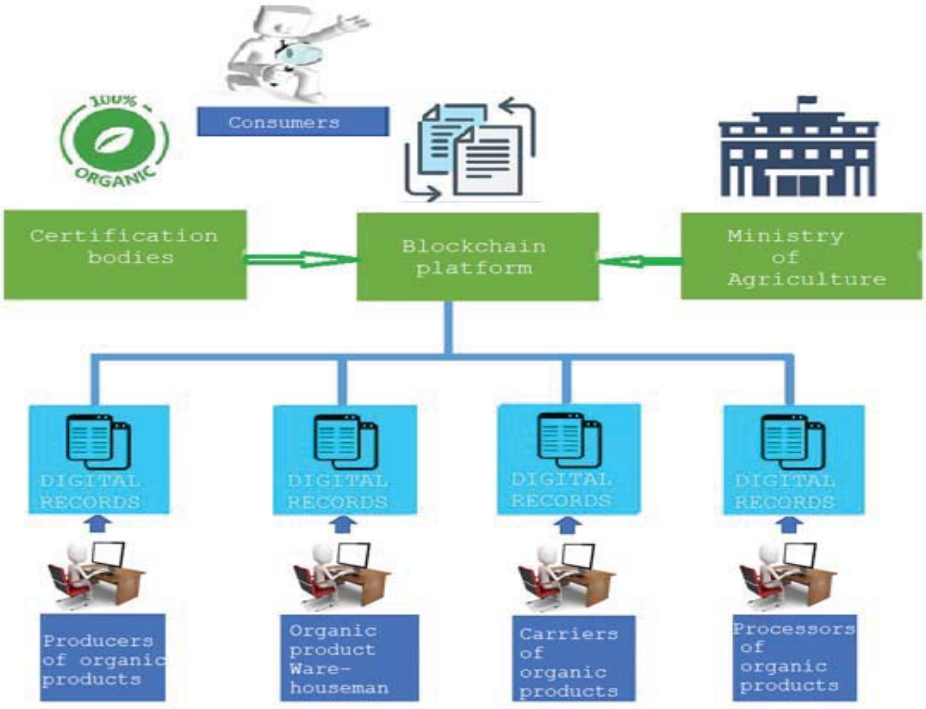
- Blockchain allow consumers to have all information associated with the products, by simply scanning the QR code on packaging.

According to FAO brochure (2020), using of the blockchain technology in agriculture have positive impact on food safety, quality and sustainability; smart contracts enable secure real-time payments; transparent data generated easily accessible to consumers. Other positive impact is seen through providing timely and accurate information by reducing information asymmetry among supply chain actors and real time information and evidence enable better public policy.

3. DISCUSSION

The Common Eu rule for organic agriculture, Regulation (EU) 2018/848 on organic production and labelling of organic products creates a legal field for introduction of the common EU production ledger in Blockchain can be used as opportunity for development of organic production, because there is increasing demands for organic product/foodstuff in EU and in Republic Serbia. In this moment each organic certification body has its own ledger for records of organic production and requirement for a different data format.

Figure 3. Blockchain in organic agriculture



Source: Kovačević et al., 2023

In Figure 3 is present the flow of blockchain applications in organic agriculture. On the presented blockchain schema between organic food producers and final customers are added the following two participants: organic production certification bodies and the institution in charge of organic agriculture supervision (most often the ministries of agriculture).

The blockchain technology in organic production will have significant effect on both supply chain and on organic agriculture policy. The institution that will make supervision can monitor data on production, processing of raw material, transport and storage.

In markets, customers will be able to get all relevant data on organic products via digital online platform (through QR scan). In this way the circle between consumers – organic products – organic producers will be increased.

CONCLUSION

The future using the blockchain technology in organic production in Republic Serbia will have many positive effects: (1) reducing administrative costs, (2) improving sales conditions, (3) expanding the market, (4) improving the supply chain, and (5) improving payment efficiency and security. This technology can be used to improve agrarian policy that is ongoing in EU and policymakers would be able to monitor the production, processing, transportation and storage of organic products and conduct evidence-based policies. So, there is recommendations that this kind of research should be persuaded in future.

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