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Using Blockchain Technology at Supply Chain: The Sample of Migros

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ABSTRACT

This study aims to determine the functionality and benefits of blockchain technology in food procurement. Within the scope of the study, Migros Trade Inc., a retail food supply company implementing blockchain technology in Türkiye, was examined as a case study. The study employed a qualitative research case study design, asking expert participants from Istanbul and Izmir to give their opinions on pre-designed themes, and conducting descriptive analyses of the data collected. The themes of the research are food supply chain, good agricultural practices, sustainability in food, blockchain applications in food supply and food safety. At the end of the study, it was found that the transparency and traceability principles of blockchain have a positive impact on consumers and supply chain stakeholders. However, challenges such as technical infrastructure and performance, as well as the reasons for not starting the process directly from the field, were the problems experienced. The data shows that blockchain technology is an efficient system that should be expanded in the food supply chain.

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Introduction

With global population growth, the need for food has increased. Besides that, such problems as food quality, food waste, carbon emission and climate change have put a burden on Food Supply Chain (FSC) management (Pandey et al., 2022; Mukherjee et al., 2022).

Local foods showing the culture of the region in terms of gastronomy tourism have become more and more important. In this respect, traceability, quality, originality, and guarantee of origin of the local foods have been significant issues in supply chain managements (Baralla et al., 2021; Curto & Gaspar, 2021). Blockchain technology serves as an important tool to ensure the safety and quality of products while increasing the traceability of food products in the supply chain process. This technology ensures that every step of food products is securely recorded and tracked, providing consumers with a more reliable and transparent shopping experience (Casino et al., 2019; Behnke & Janssen, 2020; Majdalawieh et al., 2021; Bosona & Gebresenbet 2023). Migros opens its blockchain technology, and supports the digital transformation of farmers' production processes and establishes digital agriculture stations in different fields of the various regions in Türkiye (Anadolu Group, 2024).

The main purpose of this paper is to examine the application of blockchain technology in the food supply chain management of Migros, one of the leading retail food market chains in Türkiye. Focusing on Migros as a case study, the paper aims to provide insight into how blockchain technology can improve food traceability, safety, and quality assurance in a real-world environment. Although there is a growing body of research globally on blockchain technology in supply chains, there is limited research examining its applications in the Turkish food industry. Therefore, this paper fills a gap in the literature by providing insights into the use of blockchain technology in Migros' supply chain.

Conceptual Framework

Basic shareholders comprising food supply chain (FSC) are made up of provider, producer, processing, distributor, retailer, and consumer. FSC is responsible for delivering foods coming from producers to consumers (Friedman & Ormiston, 2022). A traditional FSC system has a central, monopolist and asymmetric structure, so open to food fraud, data destruction and fake information.

For that reason, it is believed that it is not healthy to follow up food products in such systems (Pandey et al., 2022; Khan et al., 2022; Kamilaris et al., 2019). There are a great many technologies emerging to enhance and simplify the traceability for food products in supply chain systems. Among them are likely to be mentioned as QR codes, radio-frequency identification (RFID), TraceCore XM, the Internet of Things (IoT), Information and Communication Technologies (ICT) and Blockchain (Rana et al., 2021).

Because of fast processing opportunities and usability of data, Blockchain Technology (BCT) emerged as a system that could help develop a safe and secure FSC (Pandey et al., 2022). BCT or Distributed Ledger Technology (DLT) were developed to enhance food traceability (Behnke and Janssen, 2020) the transparency of information transmission, its speed and security (Khan et al., 2022, Kamilaries et al., 2019) in global supply chain systems (Baralla et al.,2 021). BCT is conceptualized as a kind of distributive technology. In current time, Industry 4.0 is regarded as one of the major tools and is used in the design, organization, operation, and general management of global FSC (Figure 1) (Sabari et al., 2019). BCT has such various features as smart contract, decentralization, transparency, traceability, data immutability and data privacy. As for consensus mechanism, it has become available to use in complicated and multi-stage supply chains (Mukherjee et al., 2022). The basic purpose of this technology is to provide the food security, sustainability of foods, their quality and health security for consumers (Chen et al., 2020).

Blockchain technology is the registry or a general/special ledger for the distributed data base of all conducted and shared digital events among blockchain participant mediators (Crosby et al., 2016). Its history could be traced up to distributed ledger technology. BCT have four basic features. These are decentralization, security, auditability, and smart execution. Decentralization is a significant feature of BCT, and it controls the adulteration of information in a way (Pandey et al., 2022) and increase information validity.

An agent in blockchain forms a new process to be added to blockchain. This new process is broadcasted in the net for verification and auditing. Majority of the knots in the chain are added to this new process chain as a block after confirming this process based on the rules determined and confirmed beforehand. Following its verification and addition to the blockchain, more than one copy is formed in a non-central way to form a security chain (Figure 2). Depending on the technology application, design for blockchain is different. General (without a written permission) and private (with a written permission) ledgers and networks could be formed (Ølnes et al., 2017).

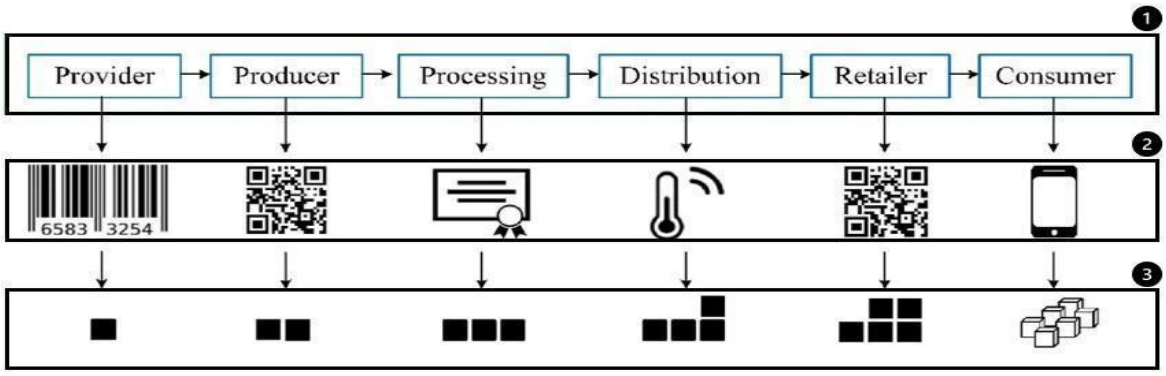


Figure 1. Sample Food Supply Chain (FSC) System adapted from Kamilaris et al. (2019).
Physical Flow (1), Digital Flow (2), BCT (3).

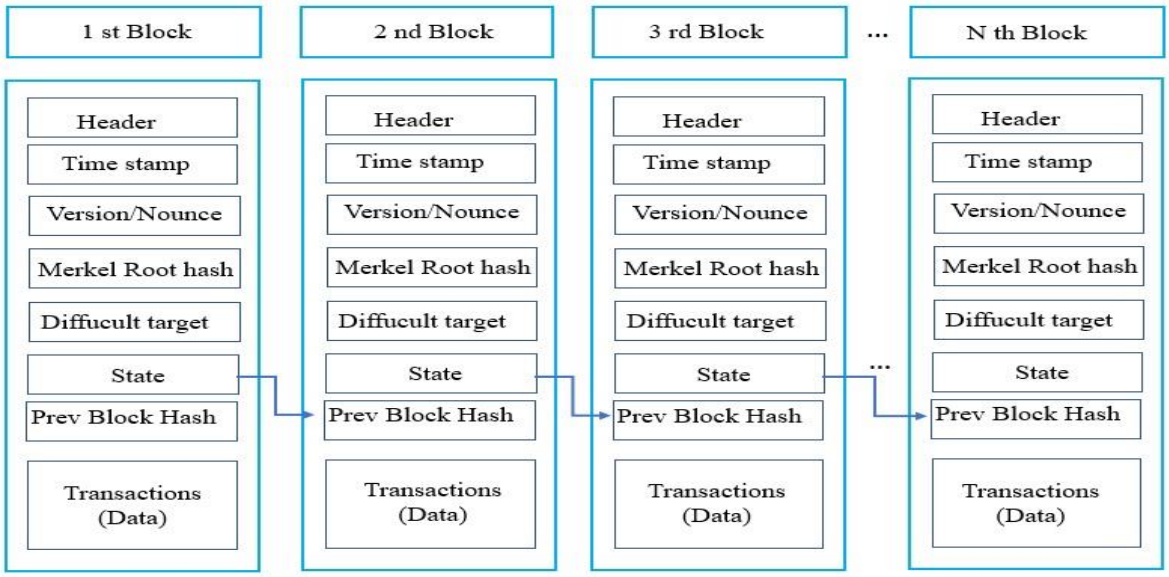


Figure 2. General structure of blockchain adapted from Pandey et al. 2022

Blockchain provides that the past of a digital entity does not change and is transparent by means of using decentralization and cryptographic hashing (Pandey et al., 2022).

Unchangeable and distributed information that is taking the registry of blockchain and sharing it is thought to be ledger. It is defined as a network where the knots coming from different nets are tied to each other but do not trust each other. Blocks, data integrity, decentralization and high security are all the features of blockchain. Today, blockchain is frequently used within the applications that has gained acceptance and verified in certain points depending on certain procedures in such chain-like systems as agri-food 4.0, healthcare, energy, environment, aquaculture and banking. The database of a blockchain is not just a chain. It is known as a ledger comprising all previous processes for all entities and having such discriminating features as decentralized control, low delay time, high yield, tamper-proof data storage and integral security (Pandey et al., 2022).

Traceability Principle in BCT

The importance of food supply chain network has increased with the process of Covid-19 in terms of reaching secure food. In this sense, traceability principle has become a necessity not only in the meaning of reaching secure food but also to better understand the life cycle of the products which are of regularity and to provide conscious consumption (Casino et al., 2019). International Organisation for Standardization (ISO) defines traceability as follows (Aung & Chang, 2014): "The ability of following up the history, application and location of what is being examined". In general, traceability means following and tracking the products throughout food supply chain (Olsen & Borit, 2013). Definition of the products and processes along with global food supply chain network gains importance in the sense of traceability at every stage.

Practicing traceability allows to form a transparency in supply chains. Conventional traceability solutions are not preferred because of such reasons as data manipulations and increase in making a mistake because of one point (Sunny et al., 2020). Efficiency of a traceability system depends on the ability of following and tracking of each product and supply chain unit. Providing an efficient traceability requires a continuous tracking starting from the primary production of a food product up to the final use of it by the consumer (Folinas et al., 2006). Traceability systems are used to enhance supply chain, provide food security, and facilitate back tracking for the protection of quality. Thanks to an effective traceability, the advantage of competition besides provision of food security will be obtained. Traceability is regarded as a strategical tool to develop the quality of raw materials and inventory management (Aung & Chang, 2014; Dasaklis & Casino, 2019; Dasaklis et al., 2019).

Blockchain traceability solutions are widely used in global terms in food and agricultural supply chains (Sunny et al., 2020). Providing food security forms one of the most significant steps in supply chain. For that reason, Hazard Analysis and Critical Control Points (HACCP) system is benefitted to prevent the hazards related to food security. Based on HACCP principles, a real-time food tracking system was formed. By this means, it was paved the way for presenting the traceability in a clear, transparent, objective, and secure way for all the shareholders of supply chain (Tian, 2017).

Transparency Principle in BCT

Traceability and transparency have totally different meanings even though they are used interchangeably in management of supply chain. Transparency is a term expressing general appearance of supply chain. Transparency of a supply chain means reaching the information regarding the product by all shareholder in a complete, without a delay and perversion (Sunny et al., 2020).

Awaysheh & Klassen (2010) puts a premium on the transparency of supply chain in terms of both customers and competitors. They point out that it is a condition that the suppliers should primarily adopt.

BCT is a technology that can support supply chain transparency in an effective way. Transparency appearing with the use of BCT plays an important role in the solution of some sustainability problems. By this means, the advantage of competition emerges (Bai & Sarkis, 2020).

Reliability Principle in BCT

It is known that blockchain system help reduce the risk of fake and unlicensed product distributed in the region. Besides that, product information, pricing and production stages are registered in a reliable way. The reason for that is that blockchain system is a decentralized registry system. A great many industries like food industry use this function in supply chains based on BCT (Arim & Li, 2021; Ronaghi, 2021). To win the confidence of the final consumers, supply chain authorities should be efficient and true in providing information. It is also of importance that supply chain authorities should obey the quality, integrity, and reliability of the whole supply chain process (Shadid, et al., 2020).

BCT and Food Security

In the 1996 World Food Summit, food security is defined as "when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). It is known that nearly 14.0% of the food products in the world is lost before reaching the consumers due to chemical and microbiological contamination (Yu et al., 2022). According to World Health Organization, the food which are not secure to consume bring about more than 200 diseases. It is pointed out that almost one of every ten people becomes ill because of the consumption of these foods (Xu et al., 2022). The increase in the global market share of food also increases the effect of the issues of changing food production and retail channels, food security on economy and trade. This case increases the need for such great scale systems as secure global supply chains (Trablus & Schmidhuber, 2018; Yu et al., 2022). It is essential that all the shareholders in food sector make a rapid response to the food problems to gain the confidence of consumers in the sector. In this sense, traceability is of importance to provide a complete appearance at each stage of the harvest, processing, and distribution at supply chain. Besides that, current supply chain management processes are based on central systems. Product data, shareholders in the chain and information sharing are controlled by just one authority. It is a model that does not offer transparency. A system deprived of transparency poses a problem in terms of reliability (Marchese & Tomarchio,

2022). Products could be tracked through BCT up to they reach consumers during all processes. In this way, the origin of the products could be seen transparently. In this means, fraud and adulteration in food products could be prevented. In addition, the mistakes caused by human factor could be reduced as the process doesn't require manual processing, food information cannot be manipulated, food security and quality could be increased (Tian, 2016).

BCT and Products with A Geographical Indication

Geographical indication is a system taking a great many products, notably food products, under protection. The importance of using BCT comes to the forefront especially with the traceability of geographically indicated food products from the producer to the consumer without any suspect. EU geographical indication programs protect knowledge, originality and agricultural – environmental conditions. If all or main qualities of a product stem from natural or human conditions of a geographical place, it is defined as "Protected Designation of Origin (PDO)"; and if one of the processes as production, processing and others at least is realized in the determined geographical region, the product is defined as "Protected Geographical Indication (PGI)" (European Commission, 2023). Reliable, traceable, and transparent features of BCT could support the development of local economy by encouraging gastronomy tourism. By means of blockchain, transparency and reliability are warranted for all actors of food supply chain and for final consumers, and traceability of food products from the producer to the final consumer could also be obtained (Baralla et al., 2018). The food products of which traceability was made through blockchain could be encouraging for the sake of buying during PDO or PGI countries, regions, or localities. For that reason, destinations should be equipped with innovative tools warranting the originality and traceability of the products.

Method

Qualitative research methods usually involve interviews and observations. In qualitative research, the questions posed to the participants aim to understand the subject to be researched (Haradhan, 2018). In qualitative research, case study design involves analyzing a situation, event, action, or process (Merriam, 2015). The goal is to analyze comprehensively and accurately a single or a few closely related situations (Yin, 2017). While descriptive analysis used in research describes a phenomenon; it also tries to answer the questions of who, what, where, when and to what extent (Loeb et al .2017). The data obtained are interpreted based on predetermined themes (Özdemir, 2010), and the subject matter is comprehended.

The study employed a qualitative research case study design, collecting the views of expert participants through pre-determined themes and descriptive analysis. In this context, firstly, a literature review was conducted on the characteristics of BCT and their relation to the food supply chain, food safety, and geographically marked products. It is aimed to examine Migros Türkiye, which uses blockchain applications in food supply chains, as a case study (refer to Table 1.).

The themes of the research are food supply chain (Kamilaris et al., 2019; Pandey et al., 2022; Mukherjee et al., 2022), good agricultural practices (Migros Corporate, 2010), food sustainability (Bai & Sarkis, 2020; Friedman & Ormiston, 2022; Mukherjee et al., 2022), blockchain applications in food supply (Kamilaris et al., 2019; Baralla et al., 202; Pandey et al., 2022; Khan et al., 2022) and food safety (FAO, 1996; Tian, 2017; Xiong H et al., 2020; Yu et al., 2022) and the questions were prepared based on these themes. The questions were presented in a semi-structured interview format, which served as a data collection tool (refer to Table 2). Additionally, the assessment included the opinions of two experts in BCT and food procurement. To enhance the research's reliability and validity, the "Migros 2023 Integrated Annual Report" and "Migros 2020 Sustainability Report", which have been approved by independent third parties, were also utilized.

The reliability of research depends on the care taken in its design and implementation (Merriam, 2015). The internal validity of the research was tried to be met through the conceptual equivalents of the themes in the interview form, which was the basis for the analysis of the findings, in the literature. Reliability, which shows the degree of consistency of the findings (Merriam, 2015), is ensured through purposive sampling, unbiased and uninterpreted interviews within ethical rules, and open and clear explanations of how the findings were reached. External validity, which is the possibility of generalizing and transferring the findings to other situations, is planned to be met by concrete universality and sample generalization.

On June 10, 2022, two volunteer experts from the Migros R&D Center Directorate (coded as P1 and P2 in the research) were interviewed in Istanbul and Izmir. The interviews were recorded and lasted for 36.55 minutes. The duration of the interviews could vary between 30 minutes and 1 hour (Başarangil & İnam, 2017). After the survey was conducted, the results were analyzed according to the themes that emerged.

A report from the Ethical Commission at Ankara Hacı Bayram Veli University, dated 27.07.2022 and numbered 2022/23, was obtained for the purpose of conducting an interview for this study.

Table 1. Research design

Type of Research	Research Question	Population/Sample	Data Collection Tool	Data Analysis and Conclusion
Qualitative case study	How are blockchain applications used in the food supply chain?	Türkiye, Migros Trade Inc.	Face-to-face interview with semi-structured interview form, audio recordings, Migros 2023 Integrated Annual Report, Migros 2020 Sustainability Report	Descriptive analysis and evaluation of blockchain applications and status through the example of Migros Trade Inc.

Table 2. Open-Ended Questions for Semi-Structured Interview Form

Q1	What is your opinion about the contribution of Blockchain technologies to food businesses?
Q2	What could be other alternatives to blockchain technologies for the transparency, traceability, and reliability of foods from the field to the table?
Q3	What could be the problems experienced in blockchain technologies in food supply chain, and their solution offers?
Q4	What is your opinion about good agriculture applications?
Q5	What do you think about the environment-friendly food supply method?
Q6	What do you think the other environment friendly strategies and plans for technological food production, supply, and marketing?
Q7	Could you inform us about sustainable food policies?

Findings

In the first phase of the interview, the study's experts provided information on developing and implementing BCT at Migros. The second subsection of the text focuses on the BCT infrastructure in Migros, specifically exploring the theme of food supply in BCT. It highlights the benefits of related BCT in the food supply chain, as well as alternative technologies and their associated problems. The third subsection continued with the themes of good agricultural practices, environmentally friendly food supply and sustainable food. The data collected during the interview was analyzed based on the identified themes in the following subsections:

Migros Trade Inc. Blockchain Application and Development Process

Migros Blockchain application stared in 2019 as "fruit-vegetable difference project". It was made in this category as almost 77.0% of its endorsement is made up of fruit and vegetables. Following necessary infrastructure studies and tests, it was applied to their own staff with the internal application developed in 2020. At the first stage, necessary enhancements were made with the feedback obtained from the application made for their staff and it was offered for the service of the customers of the store as of November 2020. As a result of the interviewers, participants P1 expressed the reason for starting the application in the fruit and vegetable category as follows:

"We firstly preferred to start in the category of fruit and vegetables since it is a product which customers are of high sensibility for the origin, the freshness and traceability of the product they purchase."

Migros' improvement process in BCT was expressed by participant P1 as follows:

"We are not at the stage of the field. We are not at the stage of warmth, one of the growing conditions in the field. We can now give the information about how long it took from the purchasing in the field up to the shelves during the transportation process, how much was it loaded, how many kilograms was it when it was delivered to distribution center, from which distribution and production centers did it pass until it reached to the store."

Infrastructure of Migros BCT

Migros BCT infrastructure was explained by P1 as follows:

"The infrastructure of Migros Blockchain technology was initiated using Microsoft Azure. Currently, the process is acted upon 3 different nodes formed on Linux processing system. To enter the information about fruit and vegetable products in the Blockchain platform and query them a "Smart Contract" was designed, a "Web Service" was designed to take product information from ERP system in certain intervals and provide the integration of it with Blockchain and finally necessary mobile applications were designed to be able query product information".

The symbol used in mobile application is given in Picture 1.

(Content of the Picture 1: "Would you like to learn the story of this apple? You can learn the journey of vegetables and fruit up to they reach the shelf in the Blockchain menu in Migros Mobile application.")

The way Migros guides for customers to the application was expressed by participant P1 as follows:

"Our customer guidance is like this. We have a Blockchain logo, and it looks like the sign of eternity. You can reach the details of the product when you click on 'Migros Blockchain' by entering it in the 'Migros Money' application and scan it for the products having the logo on the label."

The steps that customers must follow after entering Money Club application are given in detail by Migros. The application process is given in Picture 1, 2 and 3.

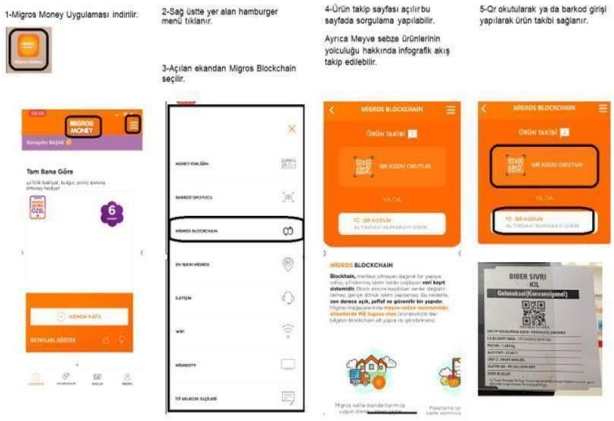
The opinion of P1 and P2 to "What is your opinion about the contribution of Blockchain technologies to food businesses?" as follows:

"Migros has always aimed to be a pioneer with such kind of applications from the time it was founded onwards, and it is a company that has made investments like this. We have segment who likes technology among our customers. They have got accustomed to it as customers, and they always expect us to initiate such leading firsts. A great many applications we have made are owned by the customers rapidly and they start using it. In this sense, blockchain is just one of them. We are trying to bring transparency to the forefront in this application. As a matter of fact, we are trying to show the customer how a product goes through a process or a journey and reaches to the shelf in a transparent way."

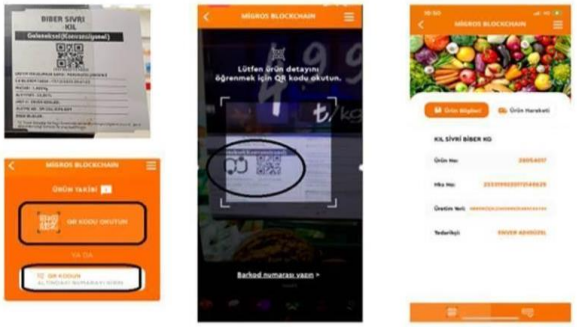
The application used by Migros Trade Inc. in this process is described above. This application can be developed and offered to customers over time in line with the requirements of the system and the developments of the company.

In a study carried out by Tan et al. (2009) into blockchain applications with Walmart sample, it was pointed out that it has such gains as reducing food security

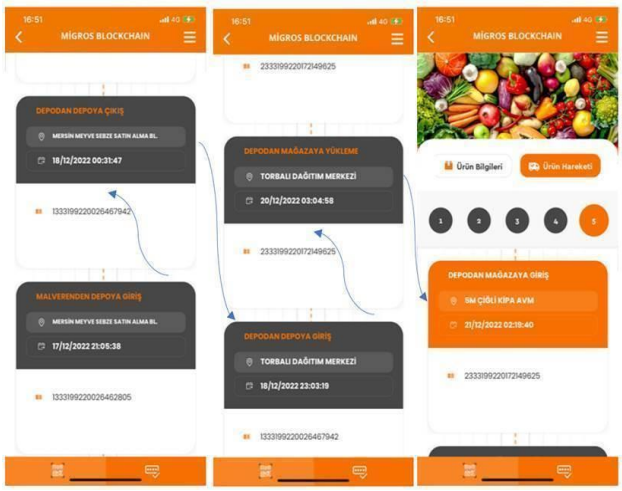
risks, increasing supply chain efficiency, accelerated cooperations and decreasing carbon footprint. In another study by Xu et al. (2022) carried out into blockchain and food security, it was found that BCT could help overcome food security risks and that some applications regarding food security could be developed. In a study by Dutta et al. (2020), it was indicated that using blockchain applications has facilities such as transparency and traceability in business process managements. It is likely to say that the findings in the study have some similarities with Migros applications.



Picture 1. The Step for QR Code Scanning



Picture 2. The Step for Reaching the Product Information



Picture 3. The Step for Accessing for Product Action

When asked, "What could be other alternatives to blockchain technologies for transparency, traceability, and reliability of food from field to table?", participant P2 responded as follows:

"The work of traceability started in Miget (the biggest meat production centre of Migros in the city of Izmir and the biggest meat production facility in Türkiye) and the works about how to track meat products in the stores by barcoding to the distribution centres from the production centre were initiated. It is carried on within the context of an R&D project. With the production of traceability barcodes, it is possible to follow them in the production infrastructure in this process and to transfer the products using these numbers to the distribution centres from the production centre and from the distribution centres directly to the stores. Why is it so important? It is so critical particularly for food products to pose a threat for health and to call the products back in the case of wrong label print. There are such processes that you must it very fast and that you must call them back before reaching the customer and you must do it even if they reach the customer. Our aim is to make the processes more digitalized with this project. For that reason, following this traceability number, recently developed software is about to be started in an almost new application and the call back process is also about to be initiated. It is essential to call unsuitable products back over party number. Besides these applications, there are two more EU application called "Medfit" and "BiofreshCloud". The purpose of Medfit is food security. It aims to prevent the adulteration of products, develop a system infrastructure that would allow to reach original product information and make this communication. Here, strawberry and tomato are taken as a pilot study in Türkiye. As an example, a system infrastructure will be set up where the tracking of tomatoes from the time it was bought from the producer up to will be made with its original product information. Similarly, the purpose of BiofreshCloud is to save the setting conditions (temperature, transportation etc.) in a cloud setting at every stage after passing the produced agricultural products from store-distribution stages. As a matter of fact, up-to-date projects are being followed in this issue."

In addition, P1 stated "In this context, in the Digital Agricultural Stations project, which we collaborated with Vodafone in 2021, a digital station application has been developed where many farmers can monitor the humidity, temperature, irrigation, etc. status information required for the crops they grow in the farm environment through sensors."

The answer given by participant P2 to the question "What could be the problems in blockchain technologies in the food supply chain, and their solution offers" is as follows:

"As a matter of fact, Blockchain is a system that we carry on working technologically in the meaning of R&D. It is in fact a system which is still being developed and hasn't reached maturity yet. There are not many stable application samples in the world. The application studies are carried out within the context of R&D. We wanted to try it firstly at fruit and vegetable category, but we tried to do a pilot application for tracking with the products that we bought from the wholesale market but not with the ones we bought from the producer. The systems are not sufficient in performance since too many registries are processed. This technology must be developed a bit more to cope with the problem of performance."

Friedman & Ormiston (2022) pointed out that "resistance" and "status quo against infrastructure and innovation" could be considered the two difficulties in using blockchain technologies. Kamilaris et al. (2019) indicated that technical infrastructure, education, policies, and regularity rules could be considered among the difficulties in using blockchain. Migros experts similarly prioritize BCT infrastructure and performance problems.

P1 and P2 additionally described the Blockchain implementation and customer feedback as follows:

"Familiarity of the application over the store is lower. We sell products to the customer over good agriculture but what the good agriculture is and what its difference from organic agriculture isn't known. This is our vision in the process of certification. While we offer certificates to people, we do it depending on a basic motto to comprise consciousness at the customer by saying that we register it with the blockchain technology, and explaining what blockchain is, what good agriculture is, what organic agriculture is. We are trying it now. I can mention about a recent questionnaire study. It was found in the questionnaire that customers who were not directly related to blockchain technology were eager to pay more for the service we offered. This is a recent questionnaire the department of fruit and vegetable marketing has conducted. In other words, they are eager to pay more for a certificated product. We are planning to reach more customers with the meat application".

Good Agricultural Applications, Environment Friendly Food Supply and Sustainable Food by Means of Using Migros Trade Inc. BCT.

Migros signed a contract of *"Good Agricultural Products"* on the date of January 2010 in the leadership of Ministry of Agriculture and Forestry. Within the context of this project, it is aimed to support both the farmers and production at global standards and to prioritise consumer health. With this project, many vegetables and fruits offered for sale at Migros Trade Inc., a retailer that includes products produced in accordance with the procedures and principles of *Good Agricultural* Practices (GAP) for the first time, started to be offered for sale with *GAP (Good Agricultural Practices)* certificate. In 2022, the company offered animal food products such as chicken, turkey, eggs, and raw milk with *GAP (Good Agricultural Practices)* certificates. Also in 2022, the company launched the *"Good Fish Project"* and contributed to the inclusion of fish farmed in Türkiye in the Good Agricultural Practices certification process (Migros Corporate, 2010; Migros Integrated Annual Report, 2023). The image regarding the application is given in Picture 4.

The image regarding the application is given in Picture 5.

Participant P1 responded to the question "What is your opinion about good agriculture applications?" as follows:

"Migros is the first thing to come to mind in good agriculture. We give a certificate and claim that we sell warranted products. But as far as we remember, we haven't met a firm selling certificated products and registering and at a database and presenting it in Türkiye. We are the store having the most product portfolios in good agricultural applications with 750 products. We started such infrastructure services that could be considered in Türkiye's conditions as "Good Agriculture", "Organic Agriculture" even "Products with a Geographical Indication" that we could offer to the customer. In other words, we can control the continuity starting from the orange we bought from the supplier in the fruit and vegetables production and distribution centre in Antalya up to the store in Ataşehir, Istanbul. In addition, what are we doing now? We carry on our works to offer the certificate of the products that we sell like "Good Agriculture", "Organic Agriculture" and offer it by benefitting from the blockchain technology. It is because there two things. One is to offer traceability data directly. When it comes to certificate, there is trust. We pay particular attention to using blockchain technology for the sake of telling and explaining the customer that the information on the certificate cannot be change in the past and no processing could be made over it. Our works are going on to load the product informations and movements coming from the suppliers directly in this process to our systems."

Picture 4. Good Agricultural Application Logo (GAA)

Migros' environmentally friendly food procurement methods are described in the "Migros Sustainability Report". Under the heading of sustainable growth together with suppliers, it is stated that supplier companies are audited based on 473 criteria in cooperation with independent external audit organizations according to corporate policies, international food safety, ethical, social, and environmental working standards. In the first step of the audits, product safety audits are conducted according to the international "IFS Food Global Market" and "IFS HPC Global Market" programs. The issues considered in this audit consist of topics such as "traceability, hygiene practices, product contamination control, pesticide control, allergen control". In the second step, they are subjected to ethical, social, and environmental audits according to international "GC Ethical Compliance" standards. These audits include topics such as "occupational health and safety, discrimination, salary policies, right to form unions". In environmental audits, the third step of the audits, "climate change impacts, carbon emissions, water use, environmental issues including soil and biodiversity, pollution control, waste management, use of natural resources and training on these issues" are taken into consideration. As a result of the audits, commercial relations are initiated, and the "GC Migros Approved Supplier" certificate is issued. (Migros Integrated Annual Report, 2023).

P2 responded to the question, "What do you think about the environmentally friendly method of food supply?".

"Today, we must take social and environmental effects into account and construct our decision-making processes accordingly as 3-dimensional ones while making all our individual, commercial and political decisions. In this sense, upon the specification of the precautions to be taken to eradicate the global hunger problem and sustain food supply security: (1) Solution of food annihilation problem and providing consumer awareness, (2) Developing production techniques with lower carbon, water, and agriculture footprints and (3) Practicing local production techniques in food as much as possible are of great importance. Besides that, basic principles of European Union Sustainable Development Goals depend on the principles of "doing no harm" and "leaving no one behind". For that reason, it is essential to protect particularly small producers, to protect the principles of woman-man equality and social equality and contributing to social health by developing the high nutritious quality of food continuously during the minimization of environmental effects."

P2 thinks as follows for "What do you think the other environment friendly strategies and plans for technological food production, supply, and marketing?".

"When the blockchain technology is improved and reaches a maturity in performance sense, we would like to add supplier dimension so that suppliers could have access to all information end to end with the registry of information regarding production to the system. We are planning to include some financers in the system with Blockchain to reduce production costs of the farmer. Also, enhancing customer demands by following them over Money club application is also among our plans. We are making our plans by taking our cultural values and habits into consideration in offering new technologies to customers."

In their study carried out by Friedman & Ormiston (2022) to investigate using blockchain technologies in food supply chains, it was pointed out that these technologies are an important tool for the sustainability. Migros indicates that they act with a similar motivation and adds that there are such issues as reducing food waste, struggling with climate change, sustainable water management, supporting sustainable agriculture and biodiversity among sustainable commitments for a liveable world in the sustainability report. According to the published report, the firm expressed that they are tied to all environmental evaluations of European Union Environment Program (UNEP) Convention on Biological Diversity that contain biodiversity as well. It also pointed out that they are an active member of One Planet Business for Biodiversity (OP2B) coalition aiming at protecting biodiversity from the it was founded onwards. Besides that, it emphasised that they have been actively carrying out the studies of making agriculture and husbandry must be sustainable with Good Agricultural Applications, protecting the seeds that are in the danger of extinction with the projects of Anatolian Flavours and Our Heritage Local Seeds in addition to the studies of extending agricultural awareness.

In addition, it is likely to see that the expression of "We are making our plans by taking our cultural values and habits into consideration in offering new technologies to customers" in the perspective of sustainable food policies is of importance in sustainable food policies.

Conclusion

Blockchain has turned into a dominant technology for the sake of increasing transparency and traceability, reducing the risk and what's more increasing trust among different shareholders in the field of food supply chain (Pandey et al., 2022). Kamilaris et al. (2019) put a premium on that fact that blockchain must be transparent, they indicated that there is a hopeful technology for food supply chain. In a study by Anastasiadis et al. (2022), traceability in BCT was investigated with a perspective of consumers and supply chain shareholders. At the end of the study, it was found that traceability had a positive effect on consumers and brought about that they adopted the traceability system throughout supply chain. In other words, traceability has a positive effect upon supply chain shareholders and leads to adoption of the systems more. In addition, it was found that these two interactions affected supply chain sustainability and circular economy in a positive way. In this sense, Migros started to use blockchain technology at fruit and vegetables in 2019. At this stage, food traceability starts in the wholesale fruit and vegetable markets, and it reaches the stores. It is indicated that there are some plans to start the system from the field indeed.

Besides transparency and traceability in food supply chain, sustainability is also an important component. In their study Mukherjee et al. (2022), they pointed out that food supply chains using blockchain technologies contribute the system to attain important sustainability compared to conventional supply chains. Migros has implemented the Migros Blockchain platform within the scope of the "Fruit and Vegetable Transparency Project". As they explained in their 2023 integrated report published on their corporate pages, this platform ensures that vegetables and fruits can be traced by consumers from the field to the store shelves. Access to the processes related to the products is provided by scanning the QR code on the labels of products with the MB logo in the fruit and vegetable aisle to the Money application. The company plans to expand its blockchain applications, which started with vegetables and fruits in good agricultural practices, with red meat and fish.

In their study, Rana et al. (2021) indicated the problems of scalability, leakage of secrecy, high cost and connection in using blockchain. Limited technological infrastructure in agriculture-food sector is the main handicap to apply this technology in an efficient way (Rafael et al., 2023). In Migros blockchain applications, making the registry of all processes to be tracked and experiencing performance problems in related stages, technological infrastructure, customer demands, and suitability are thought to be the handicaps for applications.

Upon considering BCT from the producers' point of view, it is pointed out that it helps set a trust relation with consumers and increase the esteem of products by providing individual product information in blockchain transparently. It is indicated that this case will force to increase the quality of the products in the agriculture and food sectors. As for the perspective of consumers, access to true and secure information regarding how the food is produced and proceeded is provided. BCT help to eliminate the concerns of consumers regarding food

security, food quality and foods being environment – friendly (Xiong H et al, 2020). Upon the review of the process of Migros' initiating blockchain process and the applications they would like to realize in the future,- especially their desire to extend the technology to food products other than vegetables and fruits- it is likely to say that a great many things as sustainability studies of the firm and good agricultural applications which they aim institutionally come to the forefronts the targets to be realized by blending with BCT.

It is true that raw materials are of great importance in terms of health, flavour, and aesthetic in gastronomy. BCT make a positive effect on the traceability and transparency of food products in their journey from the field up to our tables. Sicily blood orange with a geographical indication forms a transparent and traceable network of information between the producer and the consumer using BCT (Villari et al., 2020).

Looking at the benefits that BCT will provide to producers and consumers in practice; the technology provides transparency to consumers at all stages along the supply chain from farm to fork and provides the opportunity to follow the stages that products go through. When this situation is considered in terms of consumers, it is thought that it can help to eliminate concerns about food safety, especially food safety, and counterfeiting and adulteration. It can contribute to providing assurance on a national basis in protecting the sign standards of geographically marked products. At this point, it is thought that it has the potential to contribute to increasing confidence in products and expanding their usage levels.

The system can help producers, retailers, and all actors along the chain to establish a trust-based relationship with consumers and improve customer loyalty. Thanks to the transparency and monitoring system valid at every point in the production system, it is thought that it can help reduce product losses, increase efficiency, and reduce the loss of rights due to costs in case of product loss.

Looking at the theoretical benefits of BCT; The fact that it is one of the new systems emerging with the development of technology in the world provides an environment for the studies on the subject to spread to many fields. It is thought that the studies carried out can help to increase the theoretical knowledge that will provide practical benefits on food insecurity, inefficiency in soils, ineffective irrigation systems, uncontrolled pesticide use, considering the current system.

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