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On the Usage of Boron Mines as Digital Money/Investment Tool

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ABSTRACT

The aim of this study is to reveal the usability of strategic minerals, especially boron, as digital money and to bring strategic natural resources such as boron, trona and rare earth elements as investment tools and digital money to the attention of society and decision makers and to raise awareness. Within the scope of this study, boron mine was discussed and an attempt was made to raise awareness about other mines in the example of boron mine. Boron mine is a strategic mine in which potential new usage areas will be revealed through R&D studies, in addition to its current widespread usage areas in a wide range of industries. 73% of the world's known visible measured reserves of boron mine are in Türkiye. One of the reasons why countries are most affected by economic crises is that the money released by the country's central banks does not have a one-to-one equivalent in metal or foreign currency in the central banks, that is, fractional reserve banking is the system applied in the world. In this study, the usability of boron mine in full reserve banking was evaluated within the economic paradigm, and the suitability of boron mine as both digital money and investment tool was tried to be revealed. As a result of the study, it was revealed that boron mine is suitable and suitable for full reserve banking and can be used as digital money. It is also predicted that such an application will contribute to the change in the investment habits of Turkish people and that under-the-pillow gold investments will decrease significantly. Therefore, it is predicted that a significant portion of the capital waiting idle under the pillow will be directed to investment. It has also been concluded that by using boron as a digital currency, R&D studies on boron will be increased, with the advantage that a significant portion of the world's reserves are in Türkiye, and the boron market will grow accordingly. Most importantly, it has been concluded that the country's economy will gain resistance, especially against externally focused crises, and the country will have a stronger economy.

Keywords: Digital Money, Boron Mines, Investment Tool, Full Reserve Banking, Fractional Reserve Banking

1. INTRODUCTION

Money, which was first introduced into human life by the Lydians in the 7th century BC, has found a place in people's lives in different ways since then. If defined in modern terms, it is a tool that enables the exchange of goods and services in the economy between real and legal persons, and in this respect, has functions such as wealth accumulation and unit of measurement. In addition to being used to pay for goods and services received or to pay debts, one of its most important features is that it is accepted in society [1]. The word “nakit” in Turkish, cash in English, which came into Turkish from the Arabic word “nukud”, is used in the sense of cash, para-nakit in Turkish [2]. The word "PARA, MONEY in English", which is widely used in Turkish, came to our language from the Persian word 'pâre' meaning "parça, gümüş paresi, piece, piece of silver in English" [3]. According to the Dictionary of the Turkish Language Association, money (para in Turkish) means "cash and payment instrument made of paper or metal with a value written on it, printed by the state".

Money has found an important place in society, especially with humanity's transition to a settled order [4]–[7]. People have effectively offered the products they produced with the help of money for mutual benefit with other individuals and societies on a scale. Therefore, money has always been the most important object of trade, and with the influence of social change and transformation, it has come to assume four important functions over time. [8]–[10].

1. Being a means of payment for the economic mobility and exchange of goods and services

2. Being a common measure of value by which goods and services are scaled

3. It is a means of saving, accumulating wealth, enriching (accumulating value)

4. It is an economic policy tool directed through monetary policies developed and implemented by Governments and/or Central Banks.

1.1. Development of Money in Historical Process

Humans are social beings and are the creatures with the highest organized movement abilities. In addition to the need to act together in order to survive, it has led them to determine life strategies against both the other creatures/things they have to live with in the world and other people who have formed communities. People's desire to make maximum use of the environment [4] they live in and their actions in this direction have led human beings to the necessity of division of labor and mutual benefit. Although it has undergone variations over time in relation to the increase in social interaction, initially this "benefit"/"interaction" was realized through the exchange of products. The diversity of products and the search for optimum exchange opportunities due to people's demands and desires have created the need to purchase goods and services through a kind of scaling.

The difficulty that people have in finding the exact counterpart of the products they want to exchange has begun to make the concept of barter difficult over time, and the usefulness of the barter mechanism has been questioned. Because, it was becoming difficult for someone who wanted to exchange the wool he produced with honey and someone who wanted to exchange the honey he produced for wheat to trade with each other and it became difficult to reach the appropriate product/service for themselves. Such situations, as well as the difficulties of determining the quantities of mutual products in barter and the division of some products, have become the dilemmas of the barter mechanism.

Due to these needs, which are becoming increasingly difficult to meet, society has gradually introduced the use of scale values of some products (commodity money) into social life. These products, which are used as commodity money, vary regionally depending on the prevailing conditions. In some regions, products such as salt, wheat, coconut, eggs, butter, dates, etc. were more preferred, while in some regions, minerals and/or natural ornamental materials such as pearls, and even visually striking fossils such as Nummulites were used as commodity money [1]. Similar practices are still occasionally encountered in rural areas in Türkiye. Among the materials used as scale value for commodity money purposes, perhaps the most important ones were metals, especially precious metals (such as gold and silver) [6], [11]–[17]. Especially gold and silver were an important means of use as money until the 20th century. Today, gold is still used as an important investment tool by many societies.

Mineral coins (as commodity money) derive their circulation value from the value of the metal in which they are minted, not from the power and authority of the states that own these coins, and if the 1% minting fee is ignored, their market value and real value are equal to each other. [18]. Coins (fels in Ottoman Turkish) minted using a mixture of metals and alloys such as copper, nickel, aluminum and bronze [14], [19], and generally used as coins, have double value. In other words,

while their market value is higher, the value of the mineral they contain is lower [20]. Therefore, the value of such money is NOMİNAL (Fiat Money). In other words, they receive their reward from the power of official authority. It's like the US dollar today. While the cost of one US dollar is approximately 9.6 cents, its value can be significantly higher depending on the country, both in terms of coins and banknote.

The difficulty of transporting and storing commodity money such as gold and silver has led people to keep their gold and silver in money changers in return for certificates. Thus, these certificates began to be valued (accepted) in the market like the gold and silver they represent [10], [16], [17].

With the increasing spread of this system, it became institutionalized (the birth of banks), and since the 17th century, banks in Europe have introduced banknotes that do not always have exact value in the safes, but are guaranteed to be converted into precious metals when desired (fully convertible). In this newly developed system, coins printed from precious metals and their corresponding banknotes have equal payment capability. Due to trust and legal needs, over time, these types of banknotes began to be evaluated under the control, supervision and management of the state. In fact, in most countries, the printing of banknotes has begun to be done by the state. Thus, paper money (banknotes), which was promised by the states but did not have a counterpart in the state treasury as precious metals, came into circulation [17]. The permanent transition to a paper money system in the world coincided with the "Great World Depression" of 1929 [15], [17].

The connection between paper money and gold continued through the dollar (1 ounce of gold is equivalent to $35) for a while, and with the invalidation of the Bretton-Woods system that provided this standard in 1971, the connection between paper money and gold was completely eliminated, and therefore the currencies of most countries have been left to "Free Float" against each other since 1971.

In this new system, where there is no direct cash equivalent with metals or similar devices, there are many factors that determine the value of a country's currency. Therefore, the concept of "floating exchange rate" finds its equivalent in this system. These factors that determine the value of a country's currency are [17], [20];

1) international and even national reputation of the country represented by money,

2) her economy, economic power and economic size,

3) her monetary policy decisions made by central banks and the translation of these decisions into practice,

4) psychological factors such as war and sanctions affecting the markets, social, political and military events

The ones listed above are perhaps the most important ones. Therefore, today the value of money is almost entirely nominal.

The conditions listed above are generally valid for currencies with international validity. Local currencies, on the other hand, are accepted as means of payment by law, and since they do not represent a specific precious metal such as gold, their equivalents do not have to be kept in state treasuries or central banks as any metal, especially as a precious metal [9], [16], [21].

1.2. Types of Money Used Today

Money is basically classified as money with physical existence and money with legal nature. [22]. In the light of this perspective, we can group the types of money in use today under 4 subheadings:

1-Commodity Money, 2-Fiat Money 3-Bank / Deposit Money and 4-Digital / Crypto Money (Currency).

1-Commodity Money: Money that has a financial equivalent. gold, silver, copper, wheat, grapes, eggs, oil, etc.

2- Fiat Money: These are paper money put into circulation by central banks. The concept of representative money is also used for these. [9].

2-Bank/Deposit Money: Bank/Deposit Money does not have a physical existence, they represent the purchasing power arising from the accounting transactions made on the records by the banks. [8]. Bank money has no equivalent of printed paper money in the money supply. Financial currencies can also be created by banks by providing loans. The phenomenon behind the process of creating bank money is fractional reserve banking. It is based on the assumption that not all of the money in banks' deposit accounts will be withdrawn by bank depositors at the same time [23].

4-Digital / Cryptocurrency: There have been technological developments that began to develop rapidly after the second half of the 20th century and reached a dizzying level as of the beginning of the 21st century. In parallel with these technological developments and under the influence of these developments, many changes have occurred in the lifestyle of humanity. Along with changing lifestyles and socio-cultural transformations, digital and cryptocurrencies have also been included in many innovations in our lives [22]. Digital and Cryptocurrencies are innovations that human beings have never experienced in the past. These currencies, which are considered as bank money in a way, are, in the simplest terms, money that "appears on the ledger or accounting record and can be used like money in the fulfillment of debts or in a payment transaction without turning into any physical asset."

Bank money, described with the concepts of partial reserve system and money multiplier in economic doctrine, is formed as a result of banks providing the deposits they collect as loans over and over again within the banking system. Since the bank money that appears as deposit in the records of the banks does not have a physical equivalent, the bank's deposits can only increase in a dematerialized form. A very important gap/dilemma of the system is that if all depositors demand their money from banks at the same time in case of any crisis (or unusually large social events, etc.), the bank will not have the full equivalent for them and the banks will not be able to pay them because they have partial reserves. This system, called “Fractional Reserve Banking”, is largely based solely on mutual trust. The stakeholders of this trust element are depositors, banks and the central bank. Therefore, it is the establishment and continuity of this trust between the relevant stakeholders that runs the system. Therefore, when an event occurs that shakes this trust (events such as political/economic instability/crisis, war, etc. on a national and/or global scale) and this trust decreases, the system enters a dangerous process (in the case of Türkiye, İhlas Finans, Banker crises, etc., and at the international level, Ukraine -Russia War, turmoil in Syria, Israeli attacks threatening Energy Supply and Supply Security in the Middle East, etc.). In other words, the structure of the fractional reserve system is weak and fragile. Due to this fragility, there have been many financial and economic crises in the past [24], [25], as mentioned above, and so far, the most negative and severe of these on a global scale is the "2007-2009 Global Crisis" [26], [27]. The system has always been questioned, especially after these economic and financial crises. After the 2007-2009 Global Crisis, the global finance and banking system came into question again, and the full reserve banking system began to be discussed again. At the same time, trends towards digital money and crypto currencies also emerged in this period, partly as a reaction to this fragility of the system [27]. This crisis is not the first time that digital-based currencies have been used. Digital-based currencies such as IMF Special Drawing Right (SDR) and European Currency Unit (ECU) have been used before [28]. However, the recent global crisis has increased the tendency towards crypto money in a very striking way. Discussions about full reserve banking also flared up again in

this period, and new models of full reserve banking were proposed/developed according to modern financial architecture with the new advantages offered by advanced technological opportunities [29], [30]. With the introduction of cryptocurrencies into our lives, discussions about the definition of money and what can be considered money have also intensified. Nowadays, fiat money is printed by the States and banks carry out transactions with bank/deposit money. Bank money is also under the guarantee of the state.

In any case, money is an important financial instrument whose stability must be maintained. The increase in developments regarding speculation and abuse of digital/cryptocurrencies in recent years shows how important this is. This stability should be achieved largely under the control of states. Otherwise, crises/abuses are encountered. Banks that produce bank money collect deposits and provide loans. In addition, market movements of money are made through banks. The weakest point of the banking system, which operates based on partial reserves, is that they lend money they do not actually have in exchange for interest [31]. In case of any crisis, depositors' desire to withdraw the money stored in the bank causes the system to collapse suddenly, as stated before. For example, the crisis experienced by participation finance in the 1990s was actually related to the manipulation of this psychology.

Since the fractional reserve system is a system that operates on the axis of debt and interest, it turns into a kind of exploitation system not only on a local scale, but also perhaps by the most important big financial owners. Especially in countries that are not economically and politically stable, in other words, in countries that have been put in this situation (Kazakhstan may be evaluated in this way, the Trump attack on Türkiye and the December 20 Process can also be evaluated in this way), it also serves to impoverish the people and strengthen certain money brokers. The theory of bank money also faces criticism from this aspect. In essence, it can be said that the loans formed in the fractional reserve system are not in return for any savings; on the contrary, they are used for consumption rather than investment [21].

1.3. Full Reserve Banking

In the full reserve banking system, banks hold official currencies or precious metals such as gold in exchange for all their deposits. Therefore, even if all depositors come together to the bank to withdraw their money, banks have the ability to meet 100% of their demands. One of the suggestions is to keep one hundred percent gold as a full reserve against deposits [21], [32]. There are also examples of the use of this method in the past. This system, which was partially implemented especially in the UK and the USA, was not very functional. After the Great Depression in 1929, the Chicago Plan was proposed with a similar idea, but it could not come into force [21], [33]. While theoretically the discussions are about fractional reserve or full reserve, what is in the system has always been fractional reserve. However, the 2007/2009 global crisis brought the issue of full reserves to the agenda again. The Sovereign Money model, based on the Chicago plan, came to the fore in this period. In this system, it is aimed to replace bank money with digital money produced by the central bank and to have 100% of the deposits in banks as central bank money.

In the Sovereign Money model, since digital money is state money, the financial system will become more stable as the banking system will collect more savings and provide loans from their own capital. Therefore, in such a system, banks' uncontrolled production of bank money will be limited/prevented and asset bubbles caused by inflation and loans will be eliminated or minimized [29], [30]. In detail of the system, perspectives that will contribute to the central bank's increased functionality and direct relationship with the market are also discussed [34], [35]. For example, Tobin [35]'s suggestion is to provide everyone with the opportunity to open a deposit account at

central banks, which would also remove the requirement for deposit insurance. Since the Central Bank is not directly in the format of a commercial bank, there are some difficulties. For this purpose, sharing bank reserves on a share basis will make the system much stronger. Infrastructure studies for the management of the operation of the process (for Türkiye, such as the BIGA Project - currently 5 banks working together, etc., see the explanations below) will also make this approach applicable.

Although the history of full reserve banking dates back to 200 years, the fact that the system has not found widespread application is considered a significant loss [36]. In this sense, the BİGA (One Gr of Gold) project is an important approach in Türkiye and, in a way, it overlaps with full reserve banking.

According to the modern economic paradigm, the main characteristics that money should have in terms of its material are given below [1], [16], [17], [22]:

1. It is durable,
2. Easy to carry,
3. It has a homogeneous structure,
4. Divisibility,
5. Cannot be imitated and
6. Its rarity

Considering the elements that money must have in terms of its physical content (matter), if the commodity to be accepted as money is reserved somewhere and its counterpart is presented to the market digitally, in other words as fiat money, through the central bank, all the features expected from money will be fulfilled.

2. THE PLACE OF NATURAL RESOURCES IN THE CONTEXT OF FULL RESERVE BANKING, AND DIGITAL CURRENCY

According to modern economic theory, considering the properties that money should have in terms of its material, mines such as boron and trona mines, a significant portion of the world reserves of which are in Türkiye, may be ideal for a system such as full reserve banking integrated with the digital money infrastructure. The known reserves of boron and trona minerals are quite sufficient for such a system, and if desired or as needed, the system can be further strengthened by including other state-owned mines in the basket foreseen for full reserve banking. Since the minerals in question (especially boron) are both strategically important and state-owned as an underground resource, large costs will not be required to protect their reserves in the context of full reserve banking. Because their reserves are already underground and are extracted and processed/operated within a certain plan and in line with the needs. Therefore, cryptocurrencies, which are accepted as blockchain technology products indexed to these mines, can be easily released into the market. The concept of "mining/digital currency mining", which has become widely used in cryptocurrency jargon, will also find its physical counterpart on this occasion.

The fact that a significant portion of the global reserves of the boron mine, 73% of which is in Türkiye, whose value in the world markets is increasing day by day with the contribution of new

R&D studies, will make a great contribution to the Turkish economy, especially the launch of at least some of the reserves with digital equivalents based on this mine.

2.1. Digital money and applications

In order to better understand the phenomenon of digital money, it will be necessary to talk about the concepts of blockchain and smart contracts, which have an important place in the digital money infrastructure. Blockchain system is a new technology that came to the fore with the introduction of the digital cryptocurrency bitcoin in 2009. In Türkiye, blockchain-centered applications have started to be included in the 11th Development Plan (2019-2023). In this context, the strategy of implementing blockchain-based digital central bank money has been adopted. Türkiye has also accelerated infrastructure work for blockchain technology. In this context, a blockchain research laboratory was established by TÜBİTAK-BİLGEM in the country. Although cryptocurrencies such as Bitcoin use the infrastructure of blockchain technology, blockchain is not limited to cryptocurrencies only. For example, an important area of use of blockchain today is smart contracts.

Blockchain was first brought to the agenda in 2008 with an article titled "Bitcoin: A Peer-to-Peer Electronic Cash System" by a person or persons whose pseudonym is Satoshi Nakamoto. Although its most common use is with Bitcoin, it has found a wide range of usage over time. In this system, instead of a central server technology, transactions are spread over the internet and all stakeholders become a part of this security. Therefore, since responsibilities are supported by all stakeholders included in the system, it has, at least theoretically, an important shield of protection and trust. Today, blockchain also enables the transfer of valuable assets on the internet. In this respect, it has already started to become an important part of daily life. Thanks to this technology, a "trust protocol" is provided between users, and as a result, transactions become a multi-witness mechanism. Its biggest advantages are that a copy of the data is recorded by all stakeholders, that everyone can access this data, and that transactions are controlled by everyone. Therefore, since it has a multi-subsidiary security system, the data is safe. Thanks to the digital signatures and verifications that are part of the system, stakeholders' trust in each other is ensured without the need for intermediaries. Since everyone can witness the operation of the system at any time and people can easily see both their own transactions and the transactions in the system, transparency is also provided. It is also an important advantage that blockchain technology does not allow data to be changed or deleted.

However, the system also has some disadvantages. Blockchains that use proof of work as a consensus protocol consume a lot of energy. The computers used for the system are computers with advanced features to meet the needs, and the hardware costs are high. One of the disadvantages is that the basic logic of the created smart contracts is created once and cannot be changed. Moreover, the fact that the system is accessible to everyone seems to be an advantage, but it is also another disadvantage, and therefore, there is a risk of these contracts being exposed to cyber attacks [37]. One of the disadvantages of this system is the risk of losing all assets if people subject to the system forget their passwords or private keys.

Nowadays, Blockchain has started to be used in many countries by various government institutions for many purposes. In Türkiye, the "Blockchain-Based New Generation Transfer System with Physical Equivalent -BiGA" project has been implemented by Takasbank, under the responsibility of the state, for this purpose and is being developed for a versatile application area [38] and other citations in. It is a constantly developing system depending on a number of factors such as the increase in the use of the blockchain system, its widespread acceptance by society and its finding a place for itself, and it continues its development according to new emerging needs. It is the first generation (Generation 1.0) digital currency phase in the blockchain system/technology and refers

to the use of mining, encryption and block structure technologies in cryptocurrencies. Blockchain 2.0 is a phase in which “Smart Contracts” are included in the system, corresponds to the digital economy and covers a wide range of economic and financial applications. This technology covers many areas such as loans, traditional banking instruments including mortgages, stocks, bonds and forward contracts. Title deed certificate and graduation information are also included in this technology. The term “Smart Contracts” is used for all of these. In this technology, all kinds of crypto assets can be transferred. Blockchain 3.0 is called digital society.

Smart Contracts are defined as "a computer-operated transaction protocol that fulfills the terms and conditions of a contract without the need for human intervention"[38], [39]. Although the smart contract idea was first put forward by Nick Szabo in 1993 [39], it did not find application until the emergence of blockchain technology. However, Szabo [39]'s work contributed to the development of blockchain technology and also enabled the formation of blockchain 2.0 technology. Smart Contracts are algorithms that, once created, run automatically without the need for monitoring. Today, developments are expected to be made in areas such as smart home, smart city and smart transportation, especially within the scope of Industry 4.0. Transactions in smart contracts are very fast. Even the most complex contracts can be made easier with its infrastructure. This system guarantees that the transaction will only be completed when its conditions are met. Perhaps one of its most important advantages is that it offers high reliability and low-cost operation. However, in addition to its positive aspects, it also has some risks and negative aspects. The most important of these is the difficulties in bringing disputes arising from smart contracts to the judiciary, since the legal infrastructure is not yet perfect. Another disadvantage is that there is no possibility of withdrawing from the contract since there is no possibility of return. However, these disadvantages are negativities that can be eliminated as the system becomes established and widespread.

2.2. Digital investment tool suitable for the investment habits of Turkish society: BİGA Project→ and after BorPara (?)

BİGA Project was proposed and developed in this context to provide an infrastructure where dematerialized gold, whose physical equivalent is protected as a reserve in the name of Takasbank in Borsa Istanbul vaults, meets certain standards, can be transferred using blockchain technology [40]. When other existing systems other than the BiGA project are examined, it is understood that there is no physical underlying asset (commodity) behind many digital values produced with blockchain technology. Another difference is that the digital assets in those systems are not based on a real value (that is, they do not have physical equivalents) and therefore there is high volatility in the values of these digital assets due to the lack of sufficient legal infrastructure in the markets, yet.

In the blockchain-based solutions used within the scope of the BİGA project, it is aimed to ensure the transfer of a dematerialized asset that does not have a separate value of its own by having a predefined physical basis for each digital value. Thus, trust in this digital asset will be ensured, and thus possible speculations that may occur can be prevented. Within the scope of the BİGA Project, integration with the Gold Transfer System (ATS), which manages the processes of storing and dematerializing physical gold in safes, has been achieved and it is a very important advantage that the digitalization of registered gold into BİGA and the conversion from BİGA to registered gold have been made possible. In this way, a whole structure has been established between the end-to-end physical asset and the digitalized asset [40]. With the blockchain infrastructure developed within the scope of the BİGA project, transfer, reconciliation and reporting of digital assets can be achieved. This infrastructure is designed in a modular structure that allows the digitalization and transfer of other valuable assets, and studies to improve the system continue. By using this infrastructure (BİGA system), adaptations that will meet the savings expectations of Türkiye and

Turkish people may be possible. With the BİGA Project infrastructure, boron and trona minerals (also rare earth elements etc.), which are precious metals, have the potential to be a serious savings product.

So why boron and/or trona minerals (also rare earth elements etc.) as a digital currency/new investment tool? In particular, boron mine is a strategic mine and Türkiye has 73% of the world's known definitive boron reserves. Türkiye's trona reserve is also of remarkable size, and the second largest known trona reserve in the world belongs to Türkiye. These features make boron and trona mines stand out, especially boron mines, since the monopoly on mining activities is in the hands of the state. Details about the boron element and its mineral are also given below.

2.3. BIGA Project and its adaptability to BorPara

The BIGA Project system includes 3 main capabilities for digital assets: issuance, redemption and transfer. In addition to these three capabilities, there are additional capabilities such as integration between the blockchain system and ATS, reconciliation capabilities, monitoring and reporting.

The system allows the dematerialized transfer of gold balances held in banks between banks with the "Gold Transfer System", which was launched by Takasbank on July 16, 2018. Thus, the place of gold savings in the economic system has been strengthened and the way has been paved for its use as a financial instrument in the market where the competitive environment has become stronger [40].

With its integrated infrastructure, ATS has undertaken the dematerialization of physical gold held in Borsa Istanbul vaults, keeping it in domestic bank accounts at Takasbank, and electronically transferring it between accounts. Thanks to the system, individuals and legal entities have the ability to transfer their gold savings in their gold accounts in banks between each other, as in other currencies. In short, this system allows EFT of gold. Why shouldn't the same system be used for Türkiye's strategic boron mine reserves (maybe subsequently trona and other important mine reserves)! Therefore, with this study, it is primarily recommended that all organs of the existing ATS and integrated infrastructure be adapted with the necessary revisions for the use of boron mine as a digital currency and/or its launch as an investment tool.

With the ATS System, the gold physically stored in Borsa Istanbul vaults can be converted into BiGA, and the borons that have already been processed, in stocks and waiting to be processed underground can be converted into BorPara. Thus, each digital asset can be produced based on its physical basis, of which more than 73% of the world's reserves are in Türkiye. By performing conversion and reconciliation between digital assets and physical assets, end users can carry out their transactions through a bank (or authorized institution/board). Thus, users will be able to convert their BorPara assets into dematerialized boron mine whenever they wish by exchanging them through the bank (node), just as they can convert it into gold in the context of the BİGA Project. It is considered very valuable that in the founding years of the Republic of Türkiye, the Mineral Research and Exploration Institute was established to explore the country's minerals, EtiBANK was established to operate the mines found, and SümerBANK was established to process and market the operating mines.

Since the infrastructure of the system for digital BorPara has already been established/developed within the scope of the BİGA Project, the BİGA Project infrastructure and assumptions are deemed sufficient for the creation of digital BorPara rather than an additional process/infrastructure definition. In other words, institutions participating in the system for digital BorPara will be defined as nodes on the blockchain network. These nodes will keep a constantly updated copy of the data on the blockchain network. In transfer transactions, the BorPara amounts subject to transfer will be

sent encrypted and these values will be kept encrypted on the blockchain. For this reason, no one will know the amount transferred except the users who are parties to the transfer and the regulatory institution, but they will be able to confirm the accuracy of the transaction. As a result of approved transfer transactions, the relevant encrypted balances on the blockchain will be updated. These verification processes and other technical infrastructures are not further discussed in this study.

Regarding the automatic control of the system, regular checks are already carried out within the scope of the BİGA project to guarantee consistent and error-free operation of the system. The process, which started in 2018, is constantly inspected and improved through cross-checks. The main purpose of these controls and audits is that the sum of the assets on the ATS and the assets on the blockchain at any unit time is equal to the sum of the amount of boron stocked in the physical warehouse and/or already waiting to be operated underground as its digital counterpart. If this consistency is not achieved due to any unusual situation, the operation, issuance, redemption and transfer transactions will be automatically stopped and the system will be activated again after the relevant error is detected and corrected.

The user who becomes a member of Takasbank Gold Transfer System dematerializes his gold in accordance with LBMA conditions of 995/1000 purity, which is physically stored in BIST vaults. It transfers one BİGA issuance in exchange for one gram of dematerialized gold to its accounts on the Gold-Based Digital Asset Platform. Issuance transactions are carried out within the time period determined within the framework of ATS's operating rules. What needs to be done for Digital BorPara is to adapt the protocols in question by taking into account the physical/chemical properties of the boron mine.

Among metals, gold and silver are among the first elements discovered by humanity due to their colors and remarkable physical properties. Since ancient times, when humanity started using money, gold has been one of the first monetary materials used. Today, gold is still regarded as the most important means of savings. Especially in times of crisis, gold is one of the safest havens used by individuals/institutions and even states to protect their assets and economic values. Of course, there are many reasons for this [14], [15]. Some characteristics of gold and silver mines that are different from other mines have led to this result.

There are 118 elements in the periodic table, including artificial ones. If we exclude those that exist as gases, those that easily react with other elements in the natural environment to form compounds due to their high reactivity, those that are subject to degradation due to their low stability, and those that are fatal due to their radioactive properties, 30 elements remain. Among these 30 elements, when those that are abundant in nature and those that are very rare are ignored, 5 elements remain. Two of these 5 elements (rhodium, palladium) were already discovered in the 19th century. The remaining three elements are gold, silver and platinum. Since the melting temperature of platinum is extremely high (1768°C), it was not possible to melt this element and turn it into money in ancient times [12], [15]. Therefore, in the past, gold, silver and their alloys were used as money, some other metals found a place in commercial activities based on barter, and the general scale as money was paper money (banknotes), bank/deposit money and digital money.

Today, the technological opportunities reached/developed by human beings encourage us not to ignore the investment potential of strategic minerals such as boron and, moreover, to work on this subject. Boron element is an element with semiconductor properties between metal and nonmetal. Its high ability to form compounds and its ability to easily absorb neutrons make the boron element/mine one of the indispensable raw materials of the industry. Considering the advantages provided by its physical and chemical properties, boron will find a place in many areas of industry (defense industry, high technology field, those related to the construction sector, etc.) with new R&D studies on boron.

There are more than 230 known boron minerals in nature. Among these, tincal, colemanite, ulexite and kernite are the most commercially common [41]–[43]. After being processed by various mining methods, boron minerals are enriched by physical processes and concentrated boron products are obtained. The resulting concentrated or run-of-mine ore is refined by subjecting it to chemical processes and various refined boron products are obtained. The operating privilege of the boron mine belongs to the public institution Eti Maden, and the institution currently has 17 refined boron products in its portfolio. Boron is consumed mostly in the form of refined boron products in its end-use sectors, as well as directly as concentrated boron. One of the sectors where it is consumed most is the glass industry, as it increases the surface hardness and durability of the products (Trona mineral is also an important raw material of the same sector). Boron oxide is used extensively, especially in boro-silicate glass, textile type and insulation type glass fibres. In the ceramic industry, where it is widely used, boron is mostly used in glazes and filters. By using 8% colemanite in the cement industry, it reduces the clinker firing temperature and contributes to the improvement of cement properties [13], [25], [41], [44], [45].

Due to its proper adhesive protection and burr-free liquid formation properties at high temperatures, boron is also used as a protective slag forming and melting accelerator in the non-ferrous metal industry [41], [43], [44]. With the increase in research on alternative energy sources, studies on the use of boron in the field of shale gas have been encountered in recent years. When looked at by sector, 48% of boron products are used in glass, 15% in agriculture, 15% in ceramics-frit and 3% in detergent-cleaning sectors. The remaining 19% is used in areas such as chemistry, metallurgy, boron compounds, insect protection, roofing, glue, cellulose insulation plasterboard, mineral oil. World boron reserves are concentrated in Türkiye (%73), Russia, the USA and South America (Table 1). However, there are two countries with the largest reserves: Türkiye and Russia, and when evaluated in terms of production capability, they are Türkiye and the USA (Table 1) [43]. The fact that a boron exchange has not been established yet is a serious shortcoming, and pricing of boron mineral is determined not by the stock exchange channel, but by negotiations between buyers and sellers and the availability of commercial conditions. Among these, factors such as substitution of boron products or the development of substitute products, sectoral and regional effects, the sector in which the product is used and end-user consumption can be listed. The high substitution disadvantage is also significant. Therefore, boron prices are affected by substitution, competition, cost, production capacity, demand level and economic situation [46]. Although the substitution of boron products affects sectoral and regional effects, the sector in which the product is used and end-user consumption, the most powerful actor in the sector (in a sense, a speculator power) is Türkiye (60% of the market, 2021 exports are $1 billion) [43].

Table 1. World Boron reserves with 2019 data from [43].

Countries	Total Reserves (Thousandtons)	Distribution
Türkiye[1]	944.270	73,4
Russia[2,3]	100.000	7,8
USA[2,3]	80.000	6,2
Peru[2,3]	22.000	1,7
Argentina[2,3]	9.000	0,7
China[3]	36.000	2,8
Bolivia[3,4]	19.000	1,5
Chile[3,4]	41.000	3,2
Kazakhistan[3,4]	15.000	1,2
Serbia[5]	21.000	1,6

Countries	Total Reserves (Thousandtons)	Distribution
Total	1.287.270	100

1 Türkiye's boron reserves have been updated as of 31.12.2019.

2 Taken from USGS Mineral Commodity Summaries, January 2009.

3 Roskill 2015

4 Taken from USGS Mineral Commodity Summaries, January 2002.

5 Rio Tinto Annual Report 2019 https://www.riotinto.com/invest/reports/annual-report

While 59% of the production in the boron sector belongs to Türkiye and 27% to the USA, approximately 56% of the boron demand in the global market is met by Türkiye and 28% by the USA. The remainder, both in terms of production and demand, belongs mainly to countries such as Russia, China, Chile and Argentina [43]. Distribution of boron consumption by continents is given in Figure 1. Considering the heterogeneity in these distribution rates, it appears that the boron market has not yet reached saturation. This offers an advantage in favor of Türkiye with the largest reserves. Considering the consumption of boron products in the world by years (Figure 2), it can be seen that boron consumption is generally at similar levels, with minor fluctuations between 2010 and 2019. Since a significant part of the world reserves is in Türkiye, it does not make it attractive for other countries to carry out R&D studies on boron. However, R&D studies will contribute to the increase of new boron-based products and technological developments. Therefore, intensive R&D studies on boron by Türkiye will have an effect on increasing world boron consumption, which will be in Türkiye's favor in the boron market.

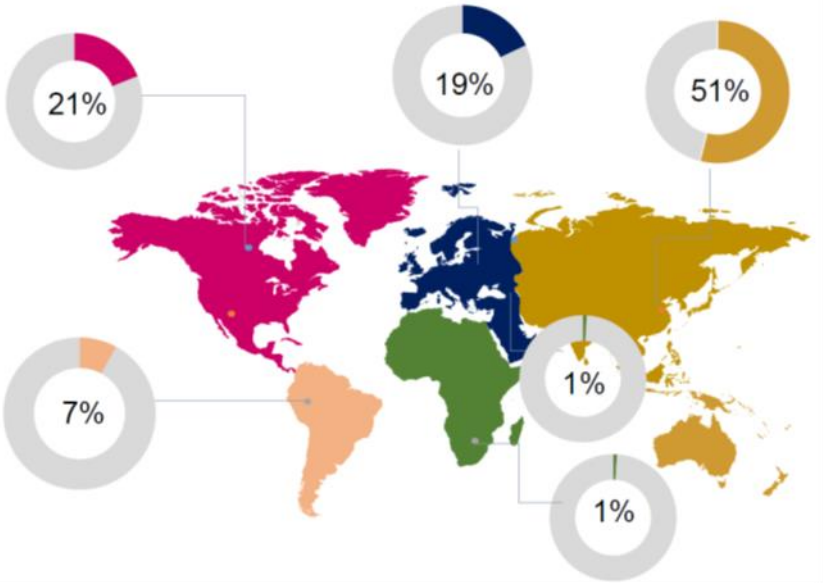

Figure 1. Geographical distribution of boron consumption rate [43]

Figure 2. World Boron Products Consumption Between 2000-2019 (thousand tons)[43]

2.3.1. Türkiye's boron production and capacity amount

Eti Maden's refined boron product production was 2.04 million tons in 2019 (Figure 3). Among the refined boron products obtained, the products with the largest production share are borax pentahydrate, ground colemanite and boric acid [43]. Although there was a decrease in the exports of boron products in 2019 compared to the previous year due to the partial contraction in the boron market as a result of the decreasing industrial production due to the negative economic and commercial developments in the world (Figure 3), this is due to the crisis and in general, the impact from the crisis is high. It seems that it is not at the level. According to Etimaden [43], despite all this crisis environment, the total boron product sales in 2019 were at a level of approximately 820 million dollars against 2.06 million tons, this picture has turned more positive in 2021 and beyond [43]. While the share of concentrated products in boron product exports is decreasing, the share of refined boron products with high added value is constantly increasing (Figure 4). This is an indication of how important the contribution of R&D studies is. EtiMaden continued its World Boron leadership, which it achieved in 2005, with a 56% share in 2019 [42], [43]. Considering the shares of producers in the boron market, it is seen that Türkiye is not in a compatible position with its boron reserves (Figure 5a). When boron product sales are compared with competing companies (Figure 5b), it can easily be said that Türkiye is not where it deserves and should be. Therefore, the use of boron mine as a digital currency will significantly contribute to the increase in the market of boron products (concentrated and/or refined and others). In this way, investor participation in the boron mine will be ensured.

In the perspective of the "National Energy and Mining" policy of the Ministry of Energy and Natural Resources of the Republic of Türkiye, emphasis has been placed on the use of boron and boron products, which are among the most important raw materials of the country, in the development of high value-added advanced technology products, and studies in this direction have been increased considerably. The establishment of boron carbide, boron nitride and ferroboron production facilities, which are used especially in fields such as defence, electrical-electronics and iron-steel, has been accelerated. The coordination of investment activities in this regard is carried out by Eti Maden, and serious progress has been made in this regard and new facilities have been established. Presenting the boron mine as digital money (BorPara) will be a powerful and innovative investment tool for domestic and foreign investors. This will also accelerate the increase in R&D studies on boron in the following period and will contribute to the development of new boron products and new usage areas of boron. Thus, as mentioned above, it will make significant contributions to the strengthening of the country's economy.

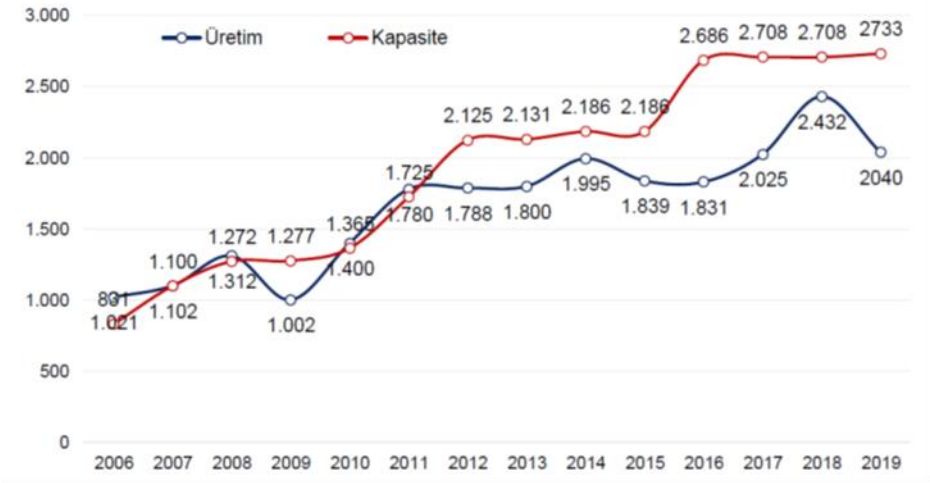

Figure 3. Refined Boron Product Production Capacity and Actual Production (thousand tons) [43]

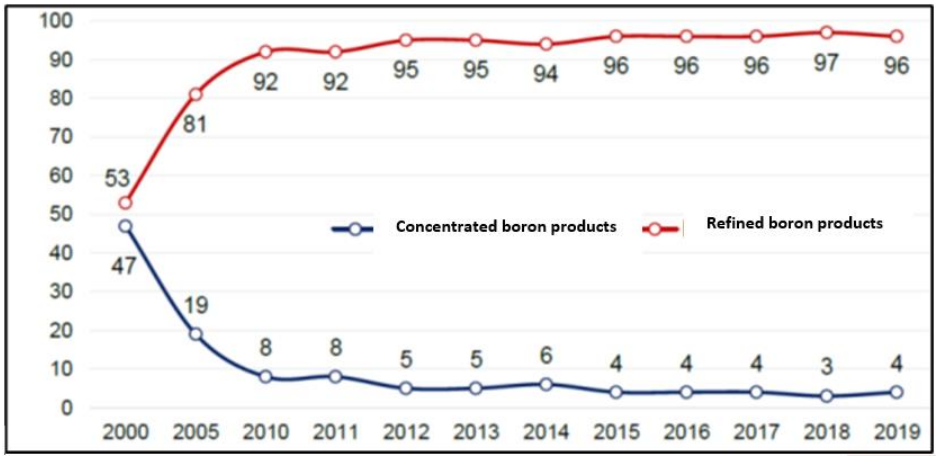

Figure 4. % Change in Refined Boron and Concentrated Boron Product Sales in Exports between 2000-2019 [42], [43]

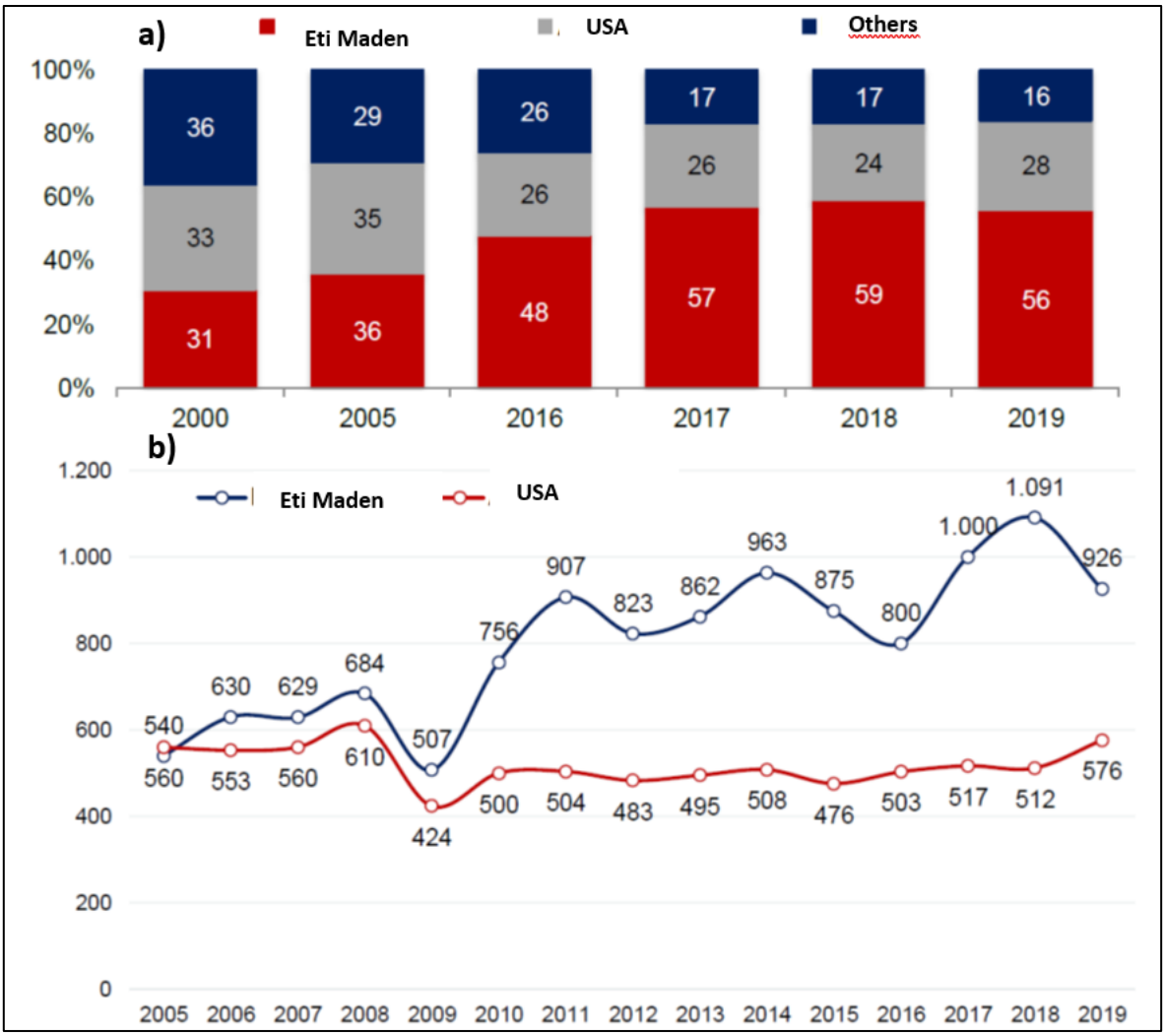

Figure 5. a) Shares of Producers in the World Boron Market by Years (Based on Quantity) b) Eti Maden and USA's boron product sales (thousand tons, as B_2O_3)

3. CONCLUSIONS

Considering the savings habits of the Turkish people, it can be said that the gold investment habit under the pillow is the most important investment habit. After the 1980s, investment activities aimed at foreign currency as well as gold and silver were used to protect people's income and continue to be used to this day. The public's reflex to avoid interest, especially bank interests, also plays an important role in this. However, these savings activities remain under the pillow and do not turn into investment. It is estimated that the savings under the pillow in this way are in the range of $ 200-300 billion. The Turkish State is trying to develop many products to turn under-pillow investments into investments by using the developing technological opportunities, the most current of which is the BİGA Project (1 gram of Gold). The BiGa project is currently a project that is being tried to be put into practice by taking only gold into consideration. In the context of the BİGA Project, presenting strategic underground resources, especially boron ore, trona, etc., to the public as digital money may cause a serious change in savings habits, especially, in the Turkish Society. Thus, the participation of a large segment of the society in national active production will be ensured. In fact, the public's contribution to underground investments, especially R&D studies, will thus enable the participation of a large segment of the society in active production. Türkiye's

possession of the world's largest boron reserves will also increase the resistance of digital BorPara produced in Türkiye against manipulation and speculation. Thus, the resistance of the Turkish economy against foreign interventions and possible global economic crises will be increased.

Conflict of Interest

The author(s) confirm that there is no known conflict of interest or common interest with any institution/organization or person.

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